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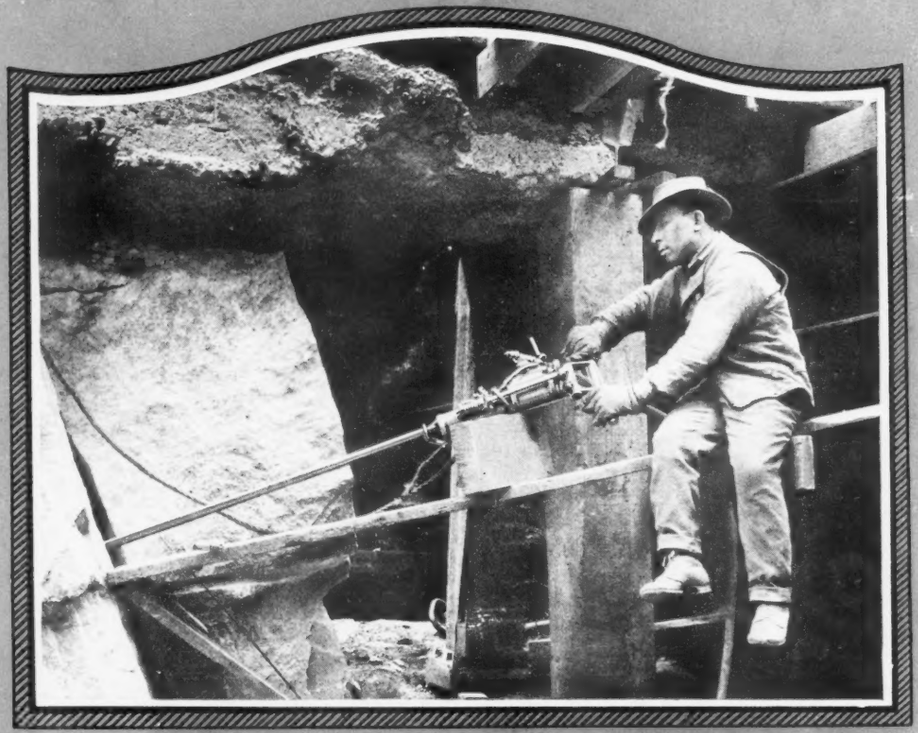

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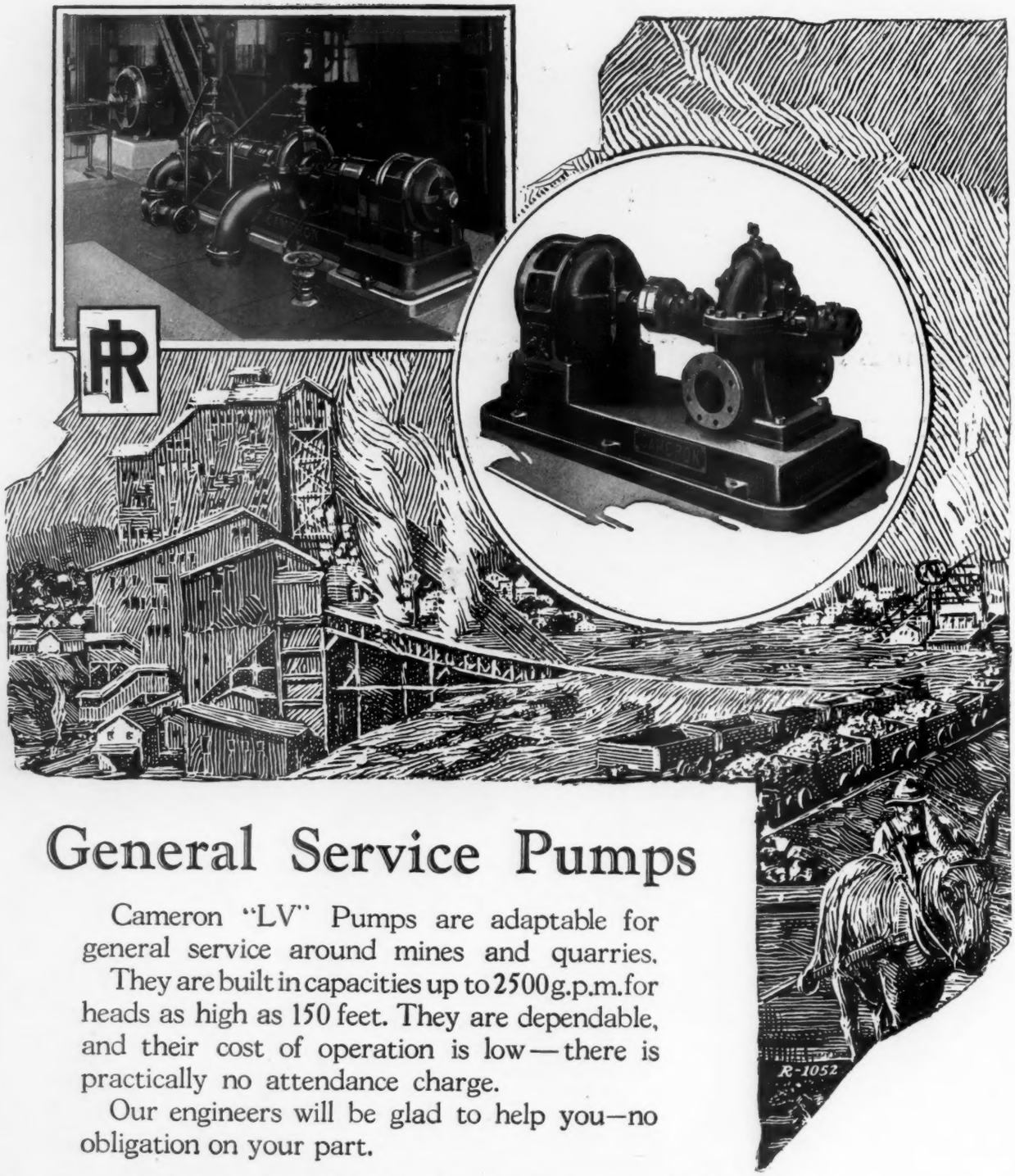


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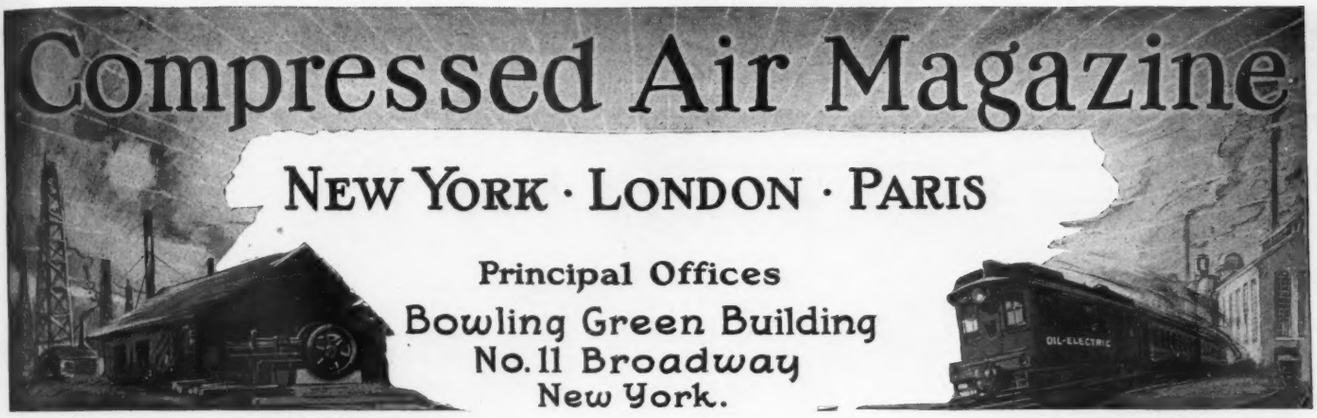


VOL. XXXI, NO. VI

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JUNE, 1926

# Oil Engines Will Have Plenty of Fuel

## Owners Need Not Fear a Shortage of Fuel For These Economical Prime Movers

By JAMES O. LEWIS

WHEN dealing with *America's Petroleum Problem* a few years ago, I laid stress upon the need of developing methods which would insure our getting more values out of such oil as we now have. This meant recourse not only to better methods of production and refining but included, as well, a more economical utilization of the petroleum available. It is probably not an overexaggeration to say that we have heretofore been extremely wasteful in the way in which we have employed fuel oil for the raising of steam for power purposes; and it is in this direction that we must henceforth economize wherever it is practicable to do so.

With this thought in mind, it will be easier for me to express an opinion as to the future supplies of fuel oil for internal-combustion engines of the so-called Diesel type—a wider employment of which has, unquestionably, been hindered by fears of a failure of our petroleum resources. This misapprehension has, in part, been the consequence of a misunderstanding or misinterpretation of the repeated warnings broadcasted by Government geologists and others to the effect that, at the present rates of consumption and under the prevailing practices in the oil-producing industry, the supplies of crude oil existing in our oil fields would last us but a few years longer.

Perhaps the situation may be summarized as follows: Supplies of cheap, "flush" oil from new pools cannot be counted on to meet all demands for many years to come; other undeveloped sources of supply are incomparably greater than the resources from which oil has been obtained up to this time, and these latent resources should meet all our more essential needs indefinitely—among these needs being fuel oil for oil engines; and, when it becomes necessary to rely on these latent resources, higher, yet not excessively high prices may be expected for petroleum products. Higher prices at such times will, no doubt, cause many users of cheap fuel oil to revert to the use of coal or to other alternative sources of heat and power. Even so, the oil engine will have such a margin of advantage over the other users of fuel oil that it will be able to compete successfully for supplies under well-nigh every conceivable contingency.

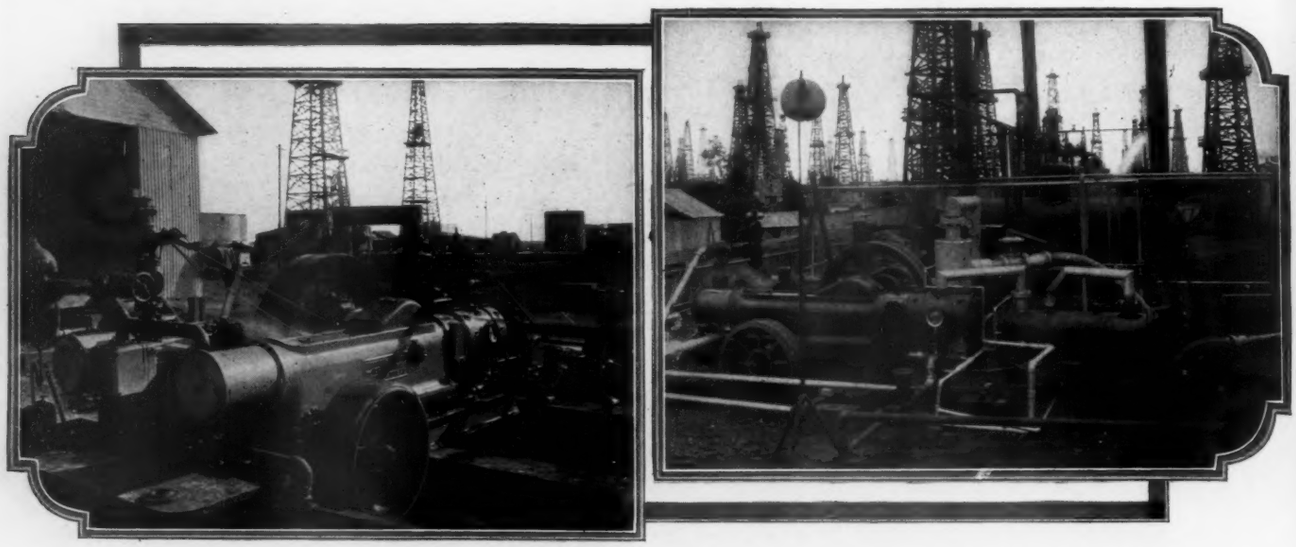
**AMERICA'S Petroleum Problem, was the title of an informative and constructive paper read before The Franklin Institute by J. O. Lewis, a while back, when filling the office of Chief of the Petroleum Division of the United States Bureau of Mines.**

**Because of the authoritative and the broad-visioned way in which Mr. Lewis then dealt with his subject, he was asked recently to prepare for the Magazine an article having to do particularly with petroleum in its use as a motive fuel for heavy-oil engines. The desire was to have him emphasize the potential effects upon engines of that sort should the price of fuel oil rise because of any relative diminution in the supply of petroleum from domestic sources.**

**In the text that follows, Mr. Lewis has made it clear that oil-engine users of petroleum need not worry about the future. This message should be a heartening one to present as well as to prospective owners of this economical type of prime mover.**

To those that have formed their opinions of this vital matter of our petroleum resources by reading only newspaper headlines, it is understandable why they should believe that the day of a fuel-oil shortage is not remote. In their endeavors to reduce the statements of Government geologists and other authorities to the limitations of headlines, the newspapers have omitted all explanations or qualifications, and therefore these captions have proved misleading to those of the public that read as they run. It has been the purpose of the experts merely to forewarn the country—not to alarm—in order that provision should be made that would enable us to pass without disruptive abruptness from the conditions to which we are accustomed to a new era of power generation wherein oil products would not be drawn from only one primary source but from many of them. That these well-intended efforts have been misinterpreted is not surprising when we consider the complexity of the problem and the difficulties incident to presenting conditions in the oil industry in an adequate way to the uninformed general public. When the whole story is told and its lesson grasped, then the future does not appear in an alarming light.

A full discussion of the many angles to the question of fuel-oil supplies for oil engines is not warranted here, and the reasons for the opinions held by the writer are presented only in brief. To the oil-engine owner, the subject resolves itself into two questions: What will be the future supply of oil? What will be the competitive position of the oil engine for such supplies as may then be available?

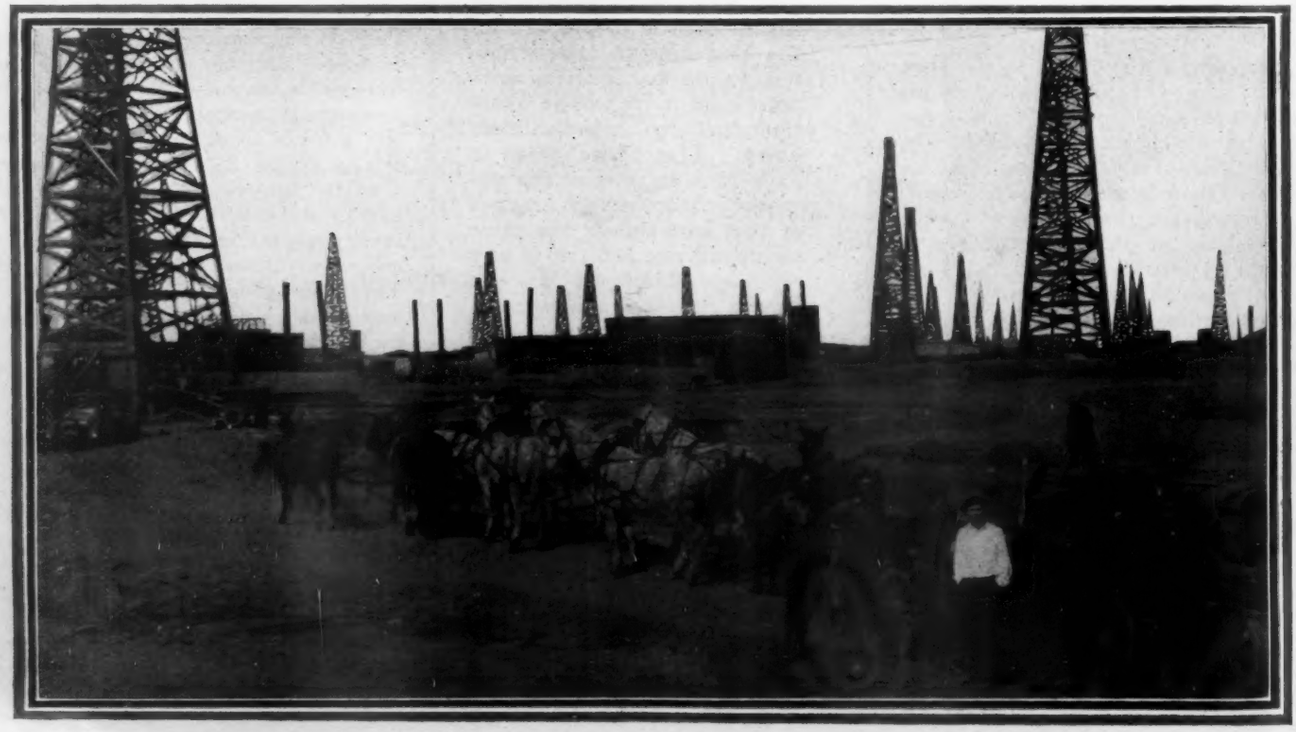


**Special portable mount for large gas compressors used to promote the flow of wells in California oil fields.**

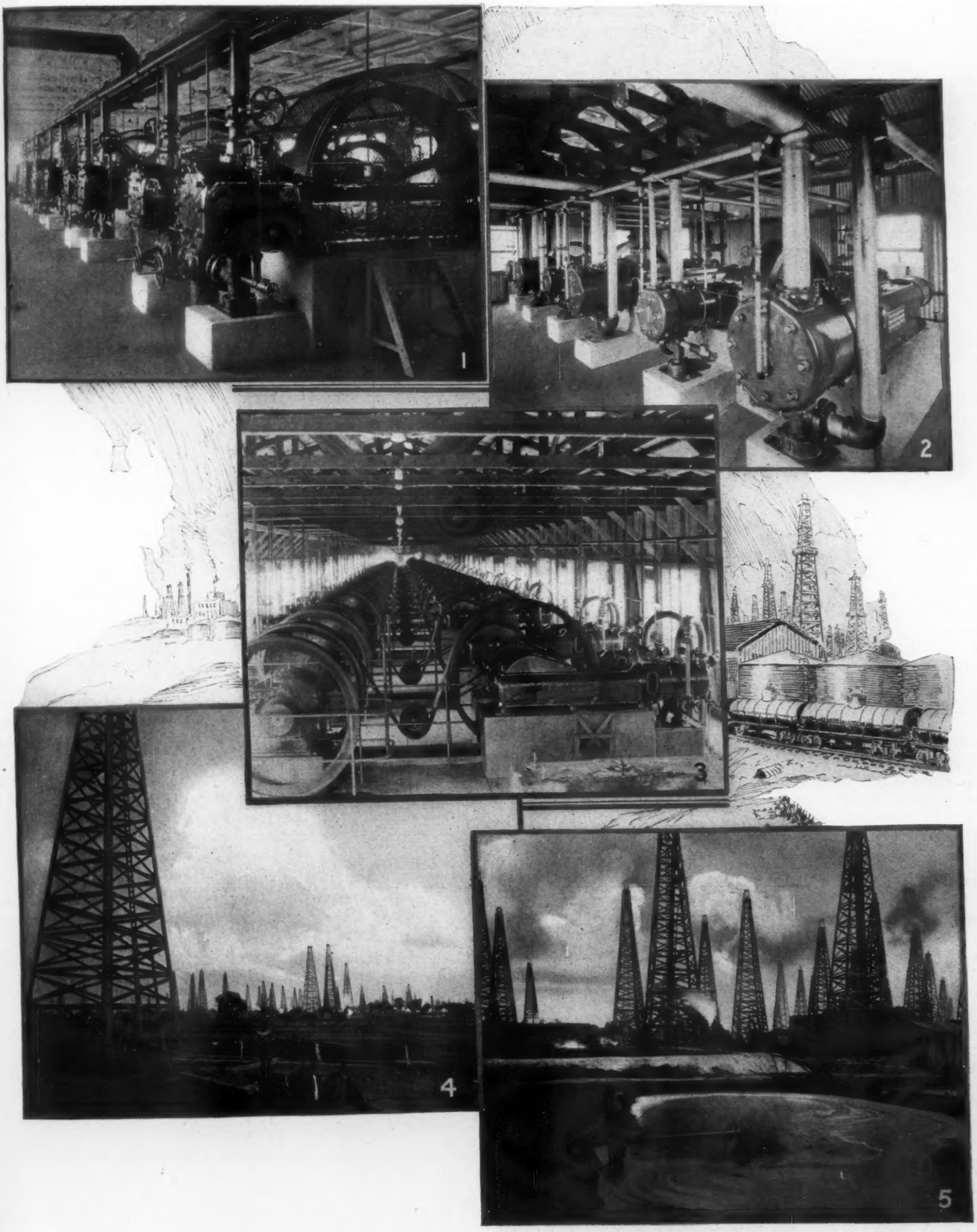
For some years in the recent past there was an oversupply of crude oil, caused by the discovery of new fields and the working of them faster than markets could be extended to absorb the increased production. Such periods of overproduction have alternated with periods of undersupply, and no one can foretell how these changing circumstances may succeed one another or how long each will endure. It is obvious, however, inasmuch as just so many pools will be discovered, that eventually the time must come when new pools can no longer be found fast enough to offset the decline of old wells—in short, the pools will not be able to provide for continually increasing consumption.

It must be understood that an oil well starts with a relatively large production and thereafter rapidly declines; and it is equally important to remember that a pool is but a number of wells. Were no new wells drilled, oil production in this country would drop anywhere from 25 to 40 per cent. in a year's time. Generally speaking, 50 per cent. of the production today is drawn from about 4 per cent. of the wells that average less than a year in age, whereas 81 per cent. of the oldest wells yield less than 10 per cent. of the production—the old wells involving a daily expense many times greater than that required in connection with the larger prolific wells. Under such conditions, our oil needs can be met only through the continued discovery of new pools that will replace or make up the depletion of the old pools; but, at the rate that these pools are being searched out, it is obvious that the time is not far distant when the production of the country as a whole must pass the peak, just as has occurred in the case of some of the older oil-producing states—but on a lesser scale.

Were there no other resources, the situation might be alarming; but we are coming more and more to evaluate not only the limitations in discovery of such new flush pools—with attendant cheap oil—but also the almost unlimited latent resources which, because of this low-priced oil, we have not had occasion to develop. These latent resources are numerous, and our



**Big air compressors arriving at a Texas oil field where they were used to blow wells to stimulate the yield.**



Photos. 4 and 5, © F. J. Schlueter.

**Fig. 1—Part of a battery of 19 I-R gas compressors in service in a large oil refinery.**
**Fig. 2—A group of 3 gas compressors similarly employed.**
**Fig. 3—A battery of 26 I-R gas compressors at work in a western oil field.**
**Fig. 4—Section of the oil field at West Columbia, Tex.**
**Fig. 5—Where the oil is impounded at West Columbia.**

future oil needs will be met from the sum of them rather than from any one of them. Production from new flush pools will not disappear overnight; but a time will come, possibly within the near future, when such production will reach a peak and thereafter gradually decline. The problem will then become one of filling in the gap between this declining production and the ascending demand for oil. This will be accomplished partly by supplementing our supplies from other sources and partly by restricting consumption by shutting off the less efficient and the less essential users of fuel oil. But that we shall be able to pass through such a period of adjustment without some inconvenience is not reasonably to be expected.

© Ewing Galloway, New York.

**Many thousands of tank cars are utilized to transport petroleum and petroleum products throughout the length and breadth of the land.**

What are these other resources? First of all, because in that way it will be possible quickest to meet any deficiency, it will be necessary to increase importations of oil from foreign countries—principally from South America. During the past decade, explorations have gone on continuously in Venezuela and Columbia, and fields have been discovered that should provide large supplies of petroleum when fully opened up. As these and other fields have been but barely scratched to date, and with much of the earth's surface not explored at all for oil, large imports can be confidently expected for many years to come; but, because of the greater cost of developments in foreign countries, this oil from alien sources will probably not be so cheap as oil is at present.

Let it be emphasized at this point that we are by no means dependent or likely to be dependent upon foreign sources of supply to make up a shortage in fuel oil. We know, as a matter of fact, that but a fraction of the oil underground in any of the domestic fields is being extracted from our oil sands by the methods commonly employed—ways will be made available by which a considerable percentage of this residual oil will be recoverable. By two different processes, already devised, oil extraction has been increased in some wells from two to four times and under profitable commercial conditions, and a third process has been worked out which has proved of practical success in Europe. It has been demonstrated conclusively that the oil remaining in the sand—after mining by the usual methods—varies from three to nine times more than the oil already extracted from the pools in question. What average increase in extraction may be looked for cannot now be fixed with any certainty—in fact, the output will be determined largely by the price asked for the oil and what outlays will be warranted in recovering it; but it is clear that a tremendous increase in the yield will come from existing oil fields. Even so, this amplified supply will not come about all at once in sensational increases in production: the stimulated yield will be spread over many years in the form of a stable, moderately priced production.

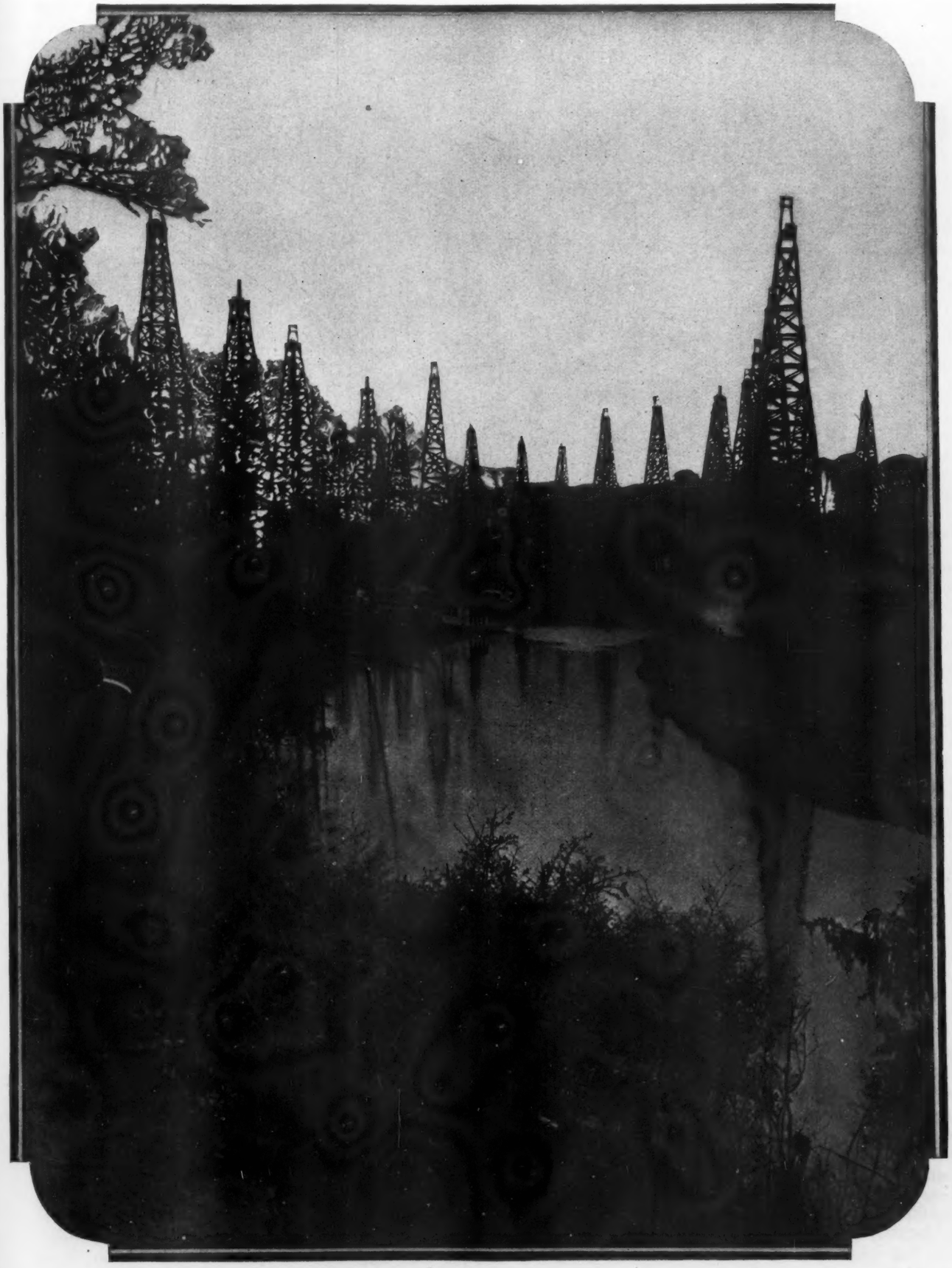
Considered upon a potential quantitative basis, the most important latent resource of fuel oil is our oil shales. These exist in enormous measures in both the eastern and the western parts of the country. Oil shale resembles a poor grade of cannel coal; and to obtain the contained oil it is necessary to mine, to crush, and to retort the shale. The quantities of oil in such shale deposits are vastly greater than the amounts of petroleum in our oil sands. Even so, the exploitation of our oil shales will require an immense sum of money and involve much time to develop satisfactory extraction methods and to install equipment of sufficient capacity to supply enough oil to meet any large share of our needs. Oil from oil shales will be available shortly, but in relatively small quantities; and the output will gradually supplement our other sources of supply as the technique is developed which will render practicable the commercial extraction of this oil on a suitable scale. Oil from these shales will be relatively but not excessively high-priced oil.

Other promising sources of liquid fuel are oils produced by the low-temperature distillation of coal as well as alcohols from various waste vegetable products and other sources. Some allowances must also be made for processes and sources not as yet demonstrated as commercially feasible—such as the chemical treatments of coal, etc., or the development of other power sources which seem remote today and yet may prove important factors in the life of an oil engine purchased at the present time. Any product that will replace gasoline will have its effect upon existing fuel oil because much of the gasoline now available is obtained by processing fuel oil.

The outstanding fact, so far as it concerns the expected useful life of an oil engine bought today, is that the future supply of liquid fuel can be drawn from large and varied sources, and the utilization of these is now merely awaiting demand. In short, a serious depletion of our oil supply is inconceivable in view of the known facts and the avenues of relief which have been opened up in part and which are susceptible of nearly unlimited development.

Such being the case, let us consider the competitive position of the oil engine in the field of power production. This

**Part of the plant of a large refinery in Oklahoma.**



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**Goose Creek, Texas, wends its way through a forest of derricks that indicates the intensive manner in which oil has been withdrawn from the underlying pool.**

subject, in itself, is fully as important as the question of the total oil supply of the country. The real concern of the oil-engine owner is his relative position—that is, whether or not he can lower his power costs and how his power costs compare with those of his competitor in making the same commodities or in selling the same sort of service. So long as his source of power is the lowest priced and most desirable for his particular operating or manufacturing conditions, then a general rise in the cost of power—affecting equally all alternative sources of power and all competitors in his field of trade—should be a matter of minor concern to him because, under such circumstances, the increased cost of power is passed right on to the consumer and the primary user of the power remains in virtually the same relative position.

The competitive position of the oil engine in the market for fuel-oil supplies is an excellent one. Fuel oils constitute about half the total of the crude oil produced and consumed. The principal uses are in steam raising, in heat making, in gas making, in household heating, in metallurgical processes, for cracking into gasoline, and for driving oil engines. The percentages by use of these various users of fuel oils are not known to the writer except that oil engines utilize but a comparatively small part of the total of the fuel oils marketed. This is still true even after due allowances are made for those kinds of fuel oils that are not so desirable for use in the Diesel type of engine.

The largest part of these competitive demands for fuel oil can be satisfactorily taken care of with coal; and during recent years the surplus supplies of fuel oil have been successfully marketed only by inducing coal users to turn to oil by underbidding rival coal. Fuel oil is, therefore, in direct competition with coal, and the price of each of these fuels logically affects the price of the other. The Diesel engine is, accordingly, in competition with coal wherever the power needs can be supplied by steam generated in coal-burning boilers. A surplus supply of fuel oil, therefore, seeking to extend its markets must undersell coal and thus tend to keep down the price of coal. On the other hand, a decreased supply of fuel oil will contract the market for fuel oil and increase the demand for coal—inducing an increase in price of both oil and coal. With a decreasing supply of fuel oil there would come a progressive restriction in the use of oil and, concurrently, a reversion to coal, to water power, or to any other sources of heat and power that might be available. This reversion would occur first in those parts of the country and in those uses in which fuel oil offers the least margin of advantage over alternative sources of heat and power; and then concentration in the employment of fuel oil would be most marked in those localities and in those uses where fuel oil is most essential. Such being the situation and the prospect, it should be plain that the oil engine, with its superior economies, will be one of the very last of the users of fuel oil to be forced out of service.

## PIONEER WORKER IN USE OF REINFORCED CONCRETE

THE present-day uses to which reinforced concrete is put are so varied that few of us realize that there was a time not so long ago when the engineering fraternity generally had little knowledge of this type of building material and less faith in its potentialities. Therefore, the following sketch of an early American investigator in this field of structural material should be of interest. We are indebted to *Research Narratives* for the particulars that are here given.

Thaddeus Hyatt, one of the first advocates of the use of reinforced concrete, was born in New Jersey in 1816 and died in 1901 at the ripe age of 85 years. Although educated for the legal profession, Mr. Hyatt was of an inventive bent, and turned that creative talent to a variety of useful purposes. Realizing the increase in property values which would occur from lighting basement areas lying under the sidewalks of cities, he early devoted himself to devising and to making an illuminating sidewalk grating; and the Hyatt grating became extensively used in New York City. After this business was so well established that he could leave its management to others, he turned his attention to other lines of investigation in which he spent considerable sums of money. One of the subjects that thus absorbed Mr. Hyatt's mind was that of finding ways to construct fireproof buildings.

In 1877, he published for private circulation a book entitled, *An account of some experiments with Portland cement concrete combined with iron as a building material with reference to economy of metal in construction and for security against fire in the making of roofs, floors, and walking surfaces.* This book, copies of which may be found in several of our important engineering libraries, gives a detailed account of what was probably the first serious and comprehensive investigation of the properties of reinforced concrete with respect both to strength and resistance to fire.

Hyatt's knowledge of the value of the combination of iron and Portland cement concrete came from his use of these materials in making his sidewalk gratings. The evidence thus gained was apparently sufficient to induce him to embark on an extensive set of experiments, which are described in his book. These experiments were made in London, where Mr. Hyatt spent a good part of his time.

Included in these experiments were 26 concrete beams reinforced in various ways, one beam of plain cement, and several of brick and tile laid edgewise with longitudinal reinforcing rods. Various methods of reinforcing were used, including longitudinal, tensile, and compressive reinforcement, bent-up rods and transverse reinforcement. The beams had a span of 5 feet, were 12 inches in width, and were from 8 inches to 12 inches deep—thus being of sufficient size to give valuable results.

In addition to the beam tests, experiments were made to determine the coefficient of expansion and the coefficient of elasticity of concrete; and a fire test was made on a good-sized floor slab. With one exception, all the conclusions that Mr. Hyatt drew from his studies and tests are in accord with present-day practice. Among these conclusions was this one: "That concrete combined with iron may not only be used satisfactorily for buildings, but that this material should also be satisfactory for bridge construction, since such a bridge should be weatherproof, need no paint, and probably cost less for repairs."

My. Hyatt was so firmly convinced of the desirable qualities of reinforced concrete for the construction of fireproof buildings that he not only used it in erecting a building in London but actually started a fire in that structure to demonstrate its fireproof qualities. Mr. Hyatt lived long enough to see the widespread application of reinforced concrete in the erection of fireproof buildings, bridges, and other structures—all of which verified his early faith in the adaptability of the material.

## COMPRESSED AIR OPERATES LARGE STEAM HAMMER

IN MOVING the repair shops of the New York Railways from one point to another in New York City, some important changes were made in the equipment for the sake of convenience and for the purpose of effecting operating economies wherever possible. Among these changes was the substitution of compressed air for steam in working a 600-pound steam hammer.

As compressed air was already available and in use in numerous ways about the shop it was only necessary to provide for additional air storage so as to be able to maintain the desired pressure when the hammer is in service. To that end, three vertical receivers were installed, and this made it possible to furnish continuously air at a working pressure of 70 pounds.

## BRITISH APPRECIATION OF AIR-SPRAY PAINTING

IN a recent lecture on air-spray painting, delivered before the Junior Institution of Engineers, Mr. F. E. Webb—according to *The Engineer*—said that, from the preservation point of view, the application of paint by means of a brush did not attain its object as well as paint sprayed on under pressure. The brush merely gives a surface coating, while the air-spray method causes the paint to penetrate into the pores of both wood and mild steel—as has been determined by microscopic examination—and to get into crevices and difficult corners not easily reached by brush. Other advantages claimed by Mr. Webb for air-spray painting were ease and rapidity of execution, and a far more perfect surface than that obtainable by the brush method.

A total of 797 wells were drilled in the Mexican oil fields during 1925. Of these 498 were abandoned and the remaining 299 proved to be producers. The wells "brought in" had an average daily initial production of 3,668 barrels, an increase of 284 barrels over that of the 296 wells "brought in" in 1924.

## PNEUMATIC TOOLS IN RAILWAY SHOPS

Fig. 1—Smoothing up weld on window frame of passenger car with Ingersoll-Rand grinder.
Fig. 2—Calking flue sheet on locomotive boiler.
Fig. 3—Drilling out stay bolts.
Fig. 4—Drilling and reaming in steel roof of passenger car.
Fig. 5—Air-motor hoist serving crosshead planer.
Fig. 6—Reaming frame of passenger car with pneumatic drill.
Fig. 7—Riveting bull ring to steel piston head with pneumatic hammers.

# Interest Widening Rapidly

## Oil-Electric Locomotive Commands Attention of the Railroad World

By J. G. SPYKE

IN these days of the telephone, the telegraph, the wireless, and the airplane, when communication with the uttermost parts of the earth is being reduced from weeks to minutes, it may perhaps be superfluous to point out that modern civilization has been founded, to a large extent, upon the development of these swift means of distributing information. In America, at any rate, it is pretty generally realized that the material needs of mankind are much alike the world over; and that the rate of human progress is largely dependent upon quick and widespread interchange of ideas and experience.

During the past few years, however, improved methods of communication have appeared in such rapid succession that, although their importance may be realized subconsciously, the average person rarely pauses to marvel. The most significant new facts, from even remote places, are commonly received as a matter of course; and only incidents of the most striking character will serve these days as reminders of the astonishing speed with which new accomplishments become known throughout the world.

Notable among such incidents is the fact that the oil-electric locomotive, although it has been in actual railroad service only about six months, has already become an object of eager interest among important transportation authorities of four continents. During the past six weeks this new type of motive power has been inspected personally at New York City by high railroad officials from England, Japan, and South America, while hundreds of inquiries and comments concerning it have been received from railroad executives and operating men in every part of the United States. The explanation is, of course, that reports of the large economies to be effected by the oil-electric locomotive have traveled far and with astonishing rapidity. And these reports have attracted almost immediate attention because they bear upon one of the most pressing and serious of modern transportation problems—that of reducing operating costs.

All available records of the performance of the oil-electric locomotive in actual railroad service appear to confirm fully the tests and calculations of the earlier demonstration period. Moreover, at least one of these performance records—that on the Central Railroad of New Jersey—now covers a period sufficient to indicate what may be regularly expected of oil-electric locomotives in the severe and continuous grind of railroad operation.

For the operating period for which data on the Jersey Central's oil-electric locomotive have been compiled, the figures are as follows:

| | |
|---|---|
| Number of days in service | 108 |
| Hours of locomotive service | 1,476 |
| Fuel-consuming hours | 1,356 |
| Fuel oil used, gals. | 4,287 |
| Lubricating oil used, gals. | 103 |
| Gasoline, gals. | 15 |
| Engine oil, gals. | 20 |
| Valve oil, gals. | 35 |
| Star cup grease, lbs. | 4 |
| Water used, gals. | 896 |
| Kilowatt-hours generated | 26,888 |

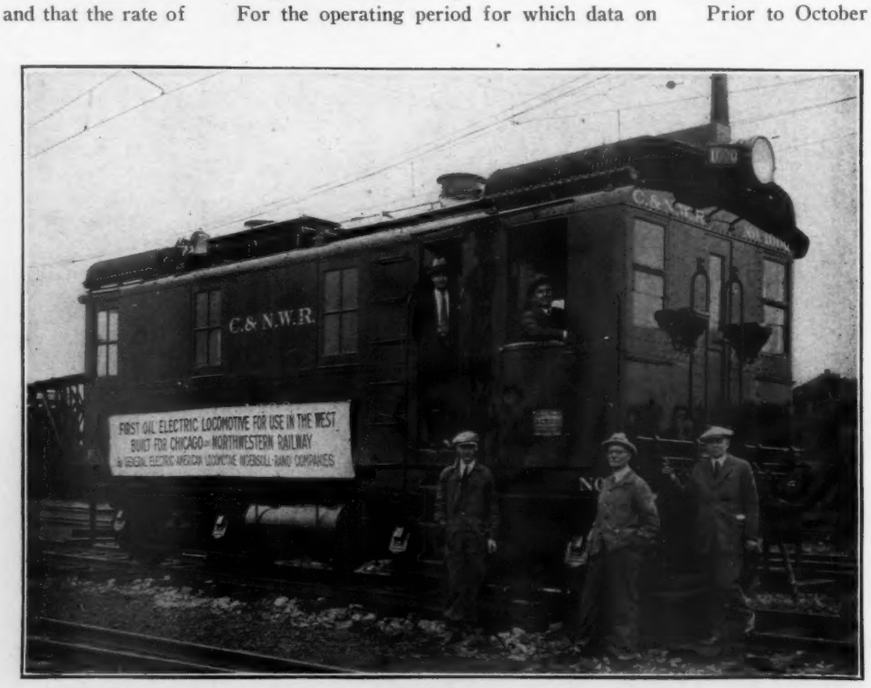
COST OF OPERATION

| | |
|---|---|
| Fuel oil, @ 5c per gal. | $214.35 |
| Lubricating oil, @ 53c and 54c per gal. | 54.83 |
| Gasoline, @ 14.5c per gal. | 2.16 |
| Water, @ 1c per 10 cu. ft. | .12 |
| Engine oil, @ 26.2c per gal. | 5.24 |
| Valve oil, @ 53c per gal. | 18.55 |
| Cup grease, @ 7c per lb. | .28 |
| **Total power costs** | **$295.53** |
| **Cost per hour of locomotive service** | **$ 0.20** |

The Jersey Central's oil-electric locomotive is of the 60-ton type, and is used at the Bronx Terminal, New York City, in handling freight cars to and from floats in the Harlem River. This work requires not only sturdiness and power, but also a maximum of flexibility in operation. The capacity to start quickly, to accelerate rapidly, and to move easily either forward or back is of the greatest importance.

Prior to October 22, 1925, an efficiently operated steam locomotive had been used by the Jersey Central in this service, and reports on the operation of this steam locomotive over a considerable period have been made available. These reports show that the average cost of the steam locomotive per hour of locomotive service was $1.20.

Reports compiled to date on the operation of the Jersey Central's oil-electric locomotive in the same service cover the period from October 22, 1925, to February 28, 1926—something over four months. As indicated in the foregoing table, the figures show that the new type of motive power was operated at an average hourly cost of 20 cents, or one-sixth that of the steam locomotive.


C.& N.W.R.
FIRST OIL-ELECTRIC LOCOMOTIVE FOR USE IN THE WEST
BUILT FOR CHICAGO & NORTHWESTERN RAILWAY
by GENERAL ELECTRIC-ALCO LOCOMOTIVE INGERSOLL-RAND COMPANIES

**The first oil-electric locomotive built for service west of New York City recently made an 820-mile trip for delivery to the Chicago & Northwestern Railway, at Chicago. At all stopping points the locomotive was visited by eager crowds; and at a number of places the new type of motive power was inspected by mayors, city managers, and delegations from local chambers of commerce. All told, about 20,000 people inspected the locomotive during its trip; and women visitors, especially, were interested because there was no smoke or noise in connection with the running of the engine.**

## LOCOMOTIVE FLUE CLEANER

Robert D. Kilcrease, engine-house foreman of the Atlantic Coast Line, Albany, Ga., has recently patented a mechanism which is said to clean locomotive flues quickly and efficiently by injecting into them a cleansing fluid under a pressure of from 70 to 130 pounds of air. According to the inventor, his main object was to provide a flue cleaner that would force the dirt and cinders out of the opposite end of the flue in case it was not entirely closed and that would prevent the cleaning compound and dirt from flowing back on the workman if the flue happened to be closed. The body of the flue cleaner is shaped to form a handle, thus enabling the operator to conveniently hold the mechanism while it is in action.

# Salt Making by Solar Evaporation

## Great Salt Lake Supplies Brine for an Interesting Industry

By ROBERT G. SKERRETT

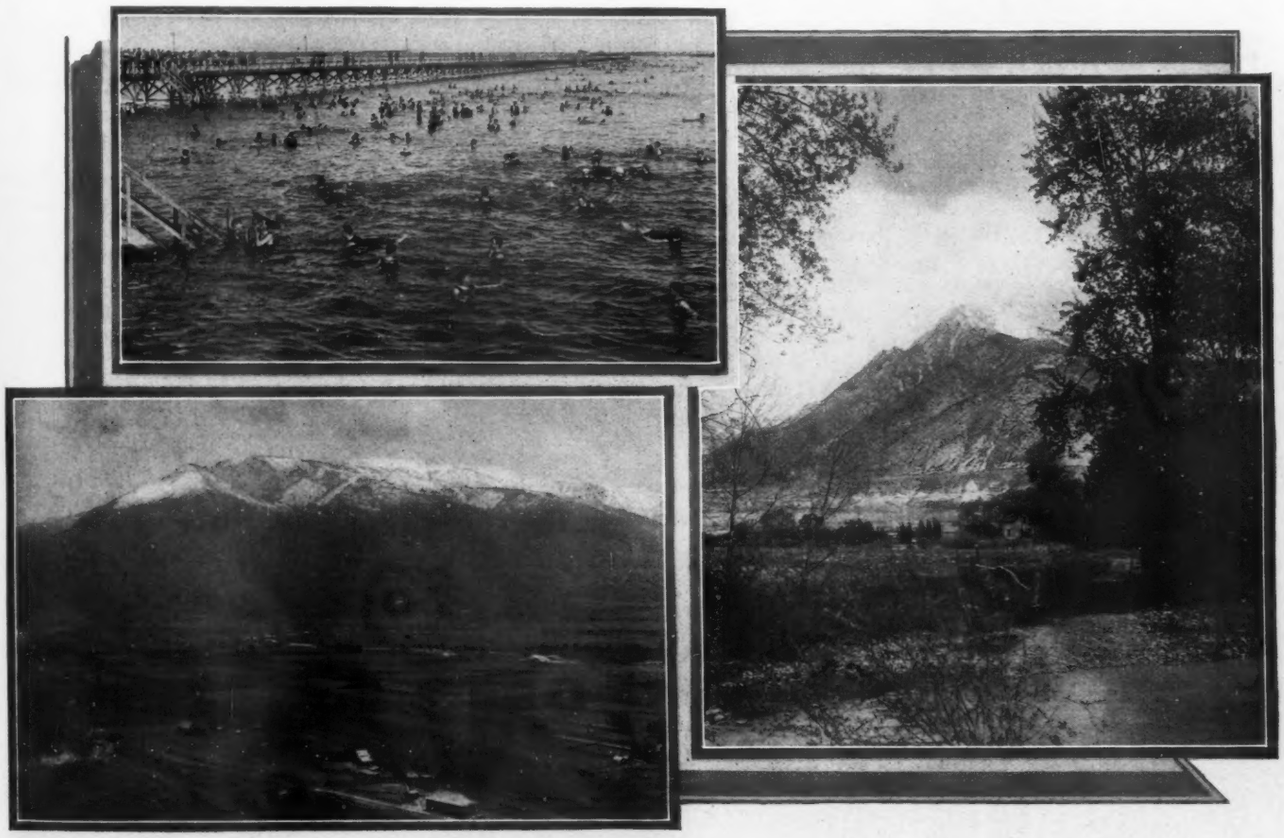
SALTAIR, Utah, besides being a pleasure resort for the citizenry of Salt Lake City, is the home of an industry that contributes to an expansive territory in that section of the West. Saltair lies on the virtually barren shore of Great Salt Lake; and it is because of the pronounced salinity of the waters of that lake that the place affords diversion in the summertime and sustains the activities of the Inland Crystal Salt Company the year round.

Just why Great Salt Lake is so salty is a geological puzzle that has not yet been solved. The saline matter is commonly believed to be due to the outpourings of brackish springs situated at various points close to the edges of the lake and to salt in solution carried to the lake by certain fresh-water streams that empty into Great Salt Lake. Be this as it may, the salinity of the lake ranges from four to seven times that of ocean water, and varies with the changes in the lake level as influenced by the volume of inflowing fresh water and the offsetting evaporation induced by solar action. Ordinarily, during the summertime the sun shines day after day with much intensity; and it is the prevalence of long periods of sunshine that is relied upon to evaporate the water and to make the residual salt available for the market.

In a general way, the composition of the saline matter in the water of Great Salt Lake differs but little from that of ocean water. The sodium content in the lake is higher than that found in sea water, but the percentage of calcium is lower while carbonates, which are present to an appreciable extent in ocean water, are almost entirely absent in the lake water.

Observations made in 1850 and subsequently revealed variations of more than 10 feet at different times in the lake level; but beach lines or benches encircling the valley in which Great Salt Lake lies tell how the lake level was a great deal higher than it has been since the first white man looked upon it. The tallest hotel in Salt Lake City would lie below the surface of the lake if the lake were as deep now as it once was. Terrestrial upheavals ages ago isolated Great Salt Lake from some of its erstwhile water sources; and protracted periods of extreme dryness induced evaporation which gradually brought about a concentration of the remaining saline matter. How long this process has gone on no one knows.

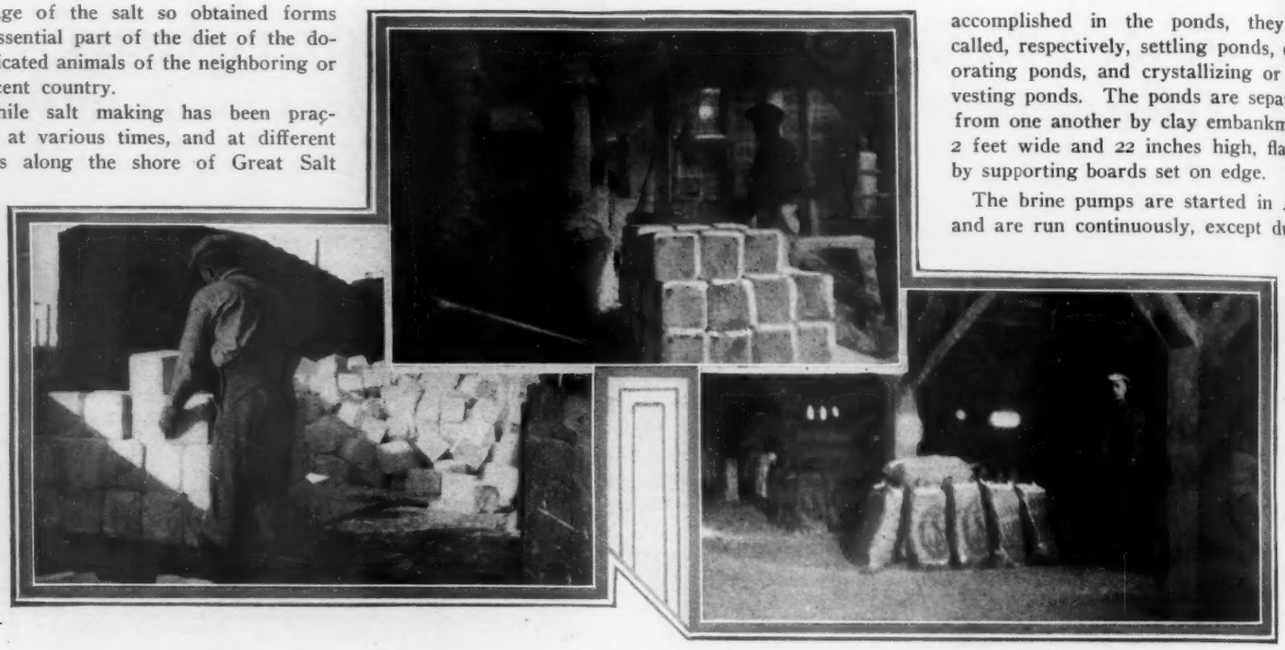
The water of Great Salt Lake, because of its exceptional density due to its salty content, will keep afloat a body that would sink in the open sea. This explains why people that cannot swim can, nevertheless, play about in the lake without any fear of going to the bottom. It is also because the water carries in solution from 20 to 23 per cent. of salt that the lake, save at the mouths of some of the tributary streams, is devoid of aquatic life. On the other hand, the water of Great Salt Lake caused the early settlers of the territory to resort to salt making by solar evaporation—in short, led to the development of an industry vital to the well-being of both man and beast. Indeed, a considerable per-



**Top—Saltair is the lakeside resort frequented by the people of Salt Lake City in the summertime.
Bottom—Part of the Valley of the Jordan with the snow-capped Wasatch Mountains in the background.
Right—Farmland in the Valley of the Jordan. The bench line at the foot of the mountain indicates where the waters of Great Salt Lake formed a beach in the ages gone.**

centage of the salt so obtained forms an essential part of the diet of the domesticated animals of the neighboring or adjacent country.

While salt making has been practiced at various times, and at different points along the shore of Great Salt Lake, the most extensive activities of this sort are those conducted in connection with the plant of the Inland Crystal Salt Company near Saltair. Saltair, by the way, is 15 miles west of Salt Lake City. The company has been in the salt-making business for more than 30 years. Before describing how the salt is treated in the mill, let us see how the lake water is handled in order to induce the solar evaporation which makes the salt ready for harvesting. The concentrating or evaporating process takes place during the spring and summer—covering a period of substantially five months, and harvesting begins in September and continues until the latter part of December. During the prolonged period of sunshine, the sun's rays, combined with the prevailing dryness of the atmosphere, promote rapid evaporation of the exposed water.

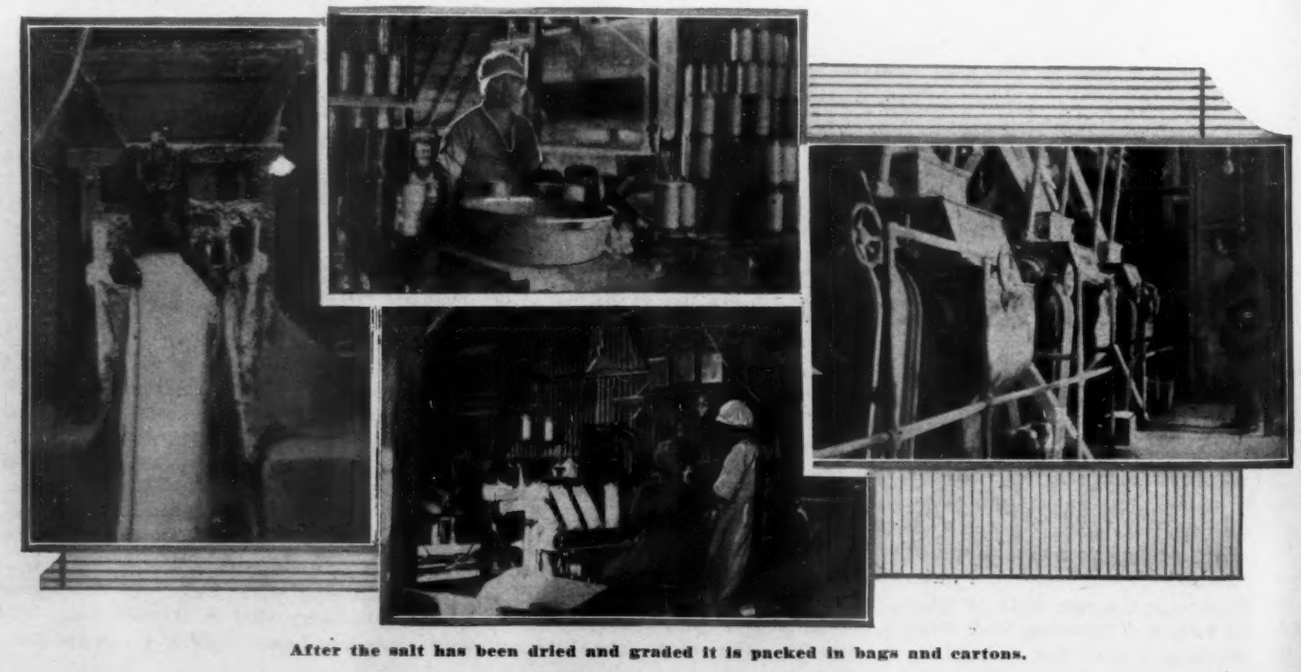


**Much salt is pressed into cubes for use in feeding cattle.**

Some of the following details are taken from a report issued a few years ago by the United States Bureau of Mines; and, simple as the story sounds, still much care and a good deal of experience are needed to insure satisfactory results. The salt ponds cover an area of 1,500 acres and are operated broadly in three groups so interconnected that each will play its particular part in the various steps that are employed. The brine is pumped from the lake into a flume by which the water is carried a distance of about 3 miles to the associate ponds. Depending upon what is accomplished in the ponds, they are called, respectively, settling ponds, evaporating ponds, and crystallizing or harvesting ponds. The ponds are separated from one another by clay embankments, 2 feet wide and 22 inches high, flanked by supporting boards set on edge.

The brine pumps are started in April and are run continuously, except during stormy weather, until the beginning of September. The season of greatest dryness and, therefore, the period of maximum evaporation, lies between the middle of June and the middle of September; and for 16 hours a day the pumps deliver water into the ponds at a rate corresponding to that of evaporation, which is equivalent to substantially 5,000 gallons a minute. The object is to maintain a contant level in the ponds as the sun vaporizes the exposed water.

As the water from the lake is drawn from the flume it goes first to the settling ponds where it usually remains from 5 to 6 days to rid it of all suspended matter. The settling ponds cover an area of approximately 75



**After the salt has been dried and graded it is packed in bags and cartons.**

acres. Next, the brine passes from the settling ponds to the stock or evaporating ponds, which have an aggregate area of one square mile. The brine remains in the stock ponds until evaporation brings about a concentration which reaches complete saturation—that is to say, the salt in the water is then ready to precipitate out of solution. The time required to attain this degree of concentration depends on the weather. From the evaporating ponds the brine is discharged into the harvesting ponds. At times, an interval of 30 days elapses between the admission of brine to the settling ponds until it is ready to enter the harvesting ponds. The brine moves by gravity from one pond to another—the flow being controlled by small gates.

When the crystallizing ponds are first laid out, and for several years thereafter, the salt is allowed to accumulate on the bottom until a layer 12 inches thick is formed. This deposit becomes as hard as concrete; and it is upon this floor that the salt for harvesting is deposited thereafter. In this way, a clean marketable product is produced. The hard floor makes it comparatively easy to remove a season's accumulation, which has an average depth or thickness of 4 inches.

The mother liquor or bittern formed in the harvesting ponds is drawn off twice—once at the middle of the season and again at the end of August. The purpose of this is to free the salt from most of the magnesium salts and the sodium sulphate contained in the lake water. It is necessary to draw off the bittern before cold weather, for otherwise the sodium sulphate would crystallize and settle and mix with the desired salt. When the bittern has been drawn off the second time, and the deposited salt is ready to be lifted, then the snowy mass is loosened with plows that may be horse drawn or pulled by tractors.

After the salt has been loosened it is harvested with scrapers and moved by wheelbarrows or hand cars to the neighboring railroad where it is stacked alongside the track for shipment to the mill. The salt is loaded in box cars and hauled to the mill where it is dried, refined, packed, or otherwise prepared for the market. Some of the salt is sold without any mill treatment.

The Saltair plant of the Inland Crystal Salt Company has an annual output of 40,000 tons. This salt has many uses and is packed or prepared accordingly. Just how far salt serves us can be gathered in a general way from the following list of applications or uses: for table or household use, in dairying, in cheese making, in ice-cream manufacture, in pickling, in meat packing, in hide curing, and in stock feeding. The salt that is sold for cattle feeding is pressed into cubes weighing 50 pounds apiece. These cubes are formed by hydraulic presses which operate at a pressure of 1,000 tons. This cattle salt is of four kinds which are known to the trade, respectively, as white, sulphurized, gray, and sulphurized gray salt.

The raw salt after it reaches the mill is first dried in rotary kilns that are fired with crude oil. A single drier will handle from 10 to 12 tons an hour; and in the course of a 24-hour day a drier will turn out an average of 200 tons of product. With the drying finished, the salt then goes to the screening and grinding room. The screening serves to separate the coarse salt and to grade it according to the size of the granules. If finer salt is desired, the salt is run through a grinder to produce the marketable grade familiar to the housewife.

**Some of the ponds and accumulated salt near Saltair, Utah.**

Compressed air has a useful but a comparatively modest part to play in the milling of the salt, and, therefore, a small compressor suffices to supply the air needed throughout the plant. Compressed air is used as a cushion on some of the hydraulic pressure lines, and it is utilized to spray water on salt dust before pressing the dust into blocks for stock feed. Compressed air is also employed to blow out or clean the numerous electric mo-

**Harvesting the salt that has accumulated on the bed of one of the ponds.**

**Salt Lake City viewed from the mountain slope north of the State Capitol Building, seen at the left. At one time Great Salt Lake covered the area below to the height of the tallest buildings in the valley.**

tors installed in different departments of the mill.

The salt, after it has been duly screened or ground to prepare it for the different markets, is put up in bags, barrels, or cartons in accordance with the trade to which it is to be sold or agreeably to the purposes to which it is to be put by the ultimate consumer. Some of the accompanying illustrations show how this work is done.

**The harvested salt is stacked alongside a railway and carried thence to the mill for treatment.**

To many of us who are familiar with overcast skies and days running when the sun is hidden, there is reason for wonderment how an industry can be confidently based upon solar evaporation. However, out in that part of the West, it is a rarity in the summertime for Old Sol to be dimmed from dawn to dusk; and during the three decades that the Inland Crystal Salt Company has been in business there has never been a shortage of essential sunshine. Not only that, but enough salt is harvested during each season to provide an ample supply to keep the mill busy for a full twelvemonth.

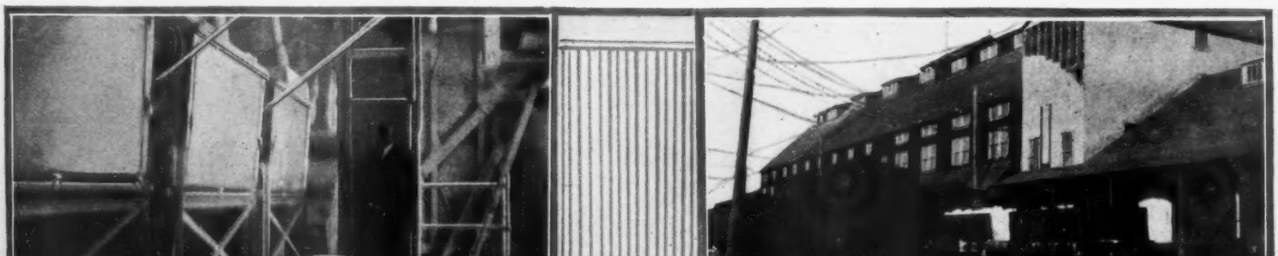
Government analysis has established the fact that the salt sold by the Inland Crystal Salt Company and made from the brine of Great Salt Lake is 99.98 per cent. pure. An especially interesting angle of the activities at the Saltair plant is the preparation of a household salt carrying a small percentage of iodine. The purpose of this is to check or to correct any manifestation of goiter—a malady that is of not infrequent occurrence in the territory served by the company in question. Goiter, as is now pretty well proved, is due in part at least to a deficiency of iodine in drinking water or in food.

## LITHIUM-BEARING MINERALS FOUND IN CANADA

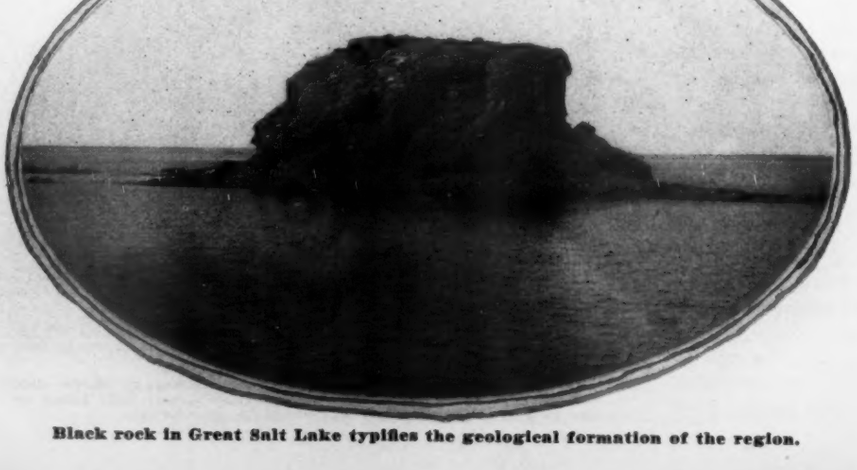
LITHIUM-bearing minerals have been discovered northeast of Pointe du Bois, south of the Winnipeg River, in the Province of Manitoba. As far as is known, this deposit is the only one of its kind in the British Empire that is within reach of existing means of transportation and available for development, although it is the second discovery in Canada of this rare silver-white metallic element—one of the alkali group—which is the lightest metal of which we have knowledge.

An analysis of the ores has revealed some valuable by-products. One of the most important of these is alumina which, it is estimated, will average 20 per cent. of the deposit. There are at least 5,000 tons of lithium-bearing mineral in sight, and there is every indication of the existence of a large body of ore in the area, which is served by the Canadian Pacific Railway. Already, a railroad has been built from the banks of the Winnipeg River to the deposit, nearly four miles inland; and six tons of ore have been crushed, bagged, and sent to England as a sample shipment.

It is the intention of the developing company to build a lithium refining plant at Pointe du Bois, where power at low cost is to be had. We might mention here that lithium is largely used in the dyeing industry, in photography, in the manufacture of fireworks, and for pharmaceutical purposes. Prominent engineers and chemists have been experimenting to determine the possibilities of refining the ore by new methods in which the available low-priced hydro-electric power could be employed to advantage.



**Left—Vibratory screens which grade the salt.**
**Right—Plant of the Inland Crystal Salt Company at Saltair.**



**Black rock in Great Salt Lake typifies the geological formation of the region.**

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The picturesque skyscraper profile of Lower Manhattan, Greater New York, is gradually extending northward. Recently, the first blast was fired that signaled the beginning of excavating for the foundation of the Christian Missionary building, at Broadway and 123rd Street, which will be 65 stories high. The normal surface of the rock on the site is 20 feet above street level, and the excavating is to be carried to a depth 20 feet below street level. This will involve the removal of 60,000 cubic yards of solid rock at a cost of $250,000.

# British Contractor Employs Pneumatic Equipment in Repairing Bridge

By A. L. MURPHY

THE contractor of today, no matter what may be the nature of his job, has to be up to date, farsighted, and ingenious if he is to complete his work on schedule time and with a reasonable profit. During the last two years, numerous contracts for demolition, construction, and repair work in Great Britain have been carried through at a loss. The reason for this in the past, aside from the menace of strikes, has been the conservative attitude that has favored placing main reliance on the use of hand methods in doing work. Fortunately, this attitude is giving way before the irresistible march of mechanical progress.

**In renovating Kelvin Bridge compressed air was employed for a variety of purposes; and, finally, the stonework was waterproofed by spraying it with a suitable protecting coating.**

Latterly, the introduction of portable air compressors and the employment of labor-lightening pneumatic tools of various kinds have done much to improve conditions for the large contractor and, likewise, to widen the field of activity of the small contractor. Broadly stated, under normal conditions, modern equipment of this sort will do certain work in about half the time that would be required if the job were done by hand. What is equally to the point, the work can thus be carried to completion at about one-third the cost of a similar undertaking in which only manual labor is relied upon.

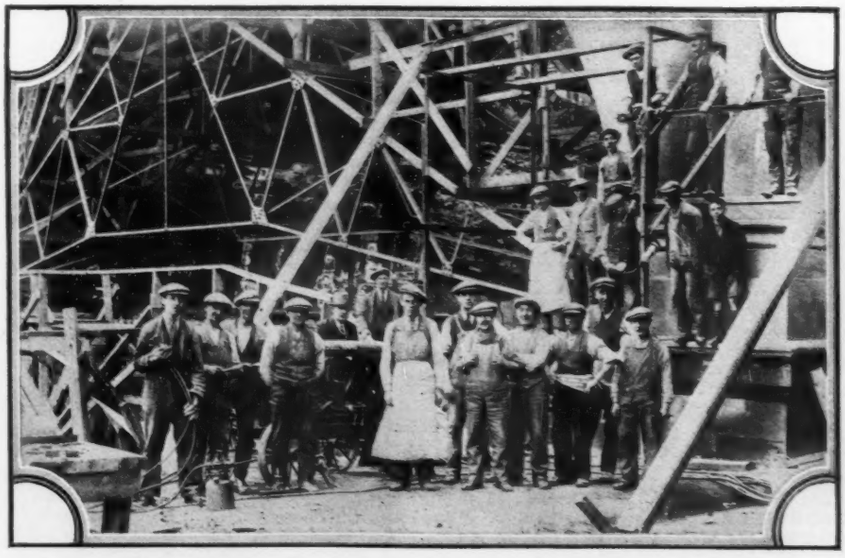
A case in point is that of the repair of Kelvin Bridge, in Glasgow, Scotland. This bridge, which was built in 1900, is approximately 226 feet long and 50 feet wide, and consists of two side spans, each of 18 feet, and of one center span 80 feet long. Being badly in need of repair, a contract for its restoration was awarded late last year to Messrs. John Emery & Sons, of Glasgow.

As the bridge over the Kelvin River is a connecting link in a much traveled main highway, it was necessary that the making of the needful repairs should be pushed with all practicable dispatch consistent with good workmanship. As the element of time saving precluded recourse to hand methods, the contractor wisely decided to utilize compressed-air equipment as far as he could do so. To that end, a 4¼x4-inch Type Twenty portable compressor was purchased and taken to the job, as were also numerous air-driven tools, such as a "Jackhamer," a chipping hammer, stone tools, and a paint-spray outfit. This list of facilities gives a good idea of the varied nature of the work that the contractor was called upon to do in reconditioning the structure in question.

The "Jackhamer," obtaining its operating air from the accessible portable compressor, was used to do quickly all necessary drilling, while the redressing and the grooving of the bridge stonework — which had become considerably damaged by weathering —was done well and expeditiously with the pneumatic chipping hammer and the stone tools just mentioned.

As Kelvin Bridge is in a relatively exposed position, the contract specified that the bridge be given a coating with a weatherproof material. And here is where the paint-spray outfit was called into service. Obviously, a man using such an air-operated outfit can cover a much larger surface in a given time that it would be possible for him to coat by brush. Indeed, experience has disclosed that the pneumatic application of paint results in a better coating, a more effective use of the paint, than when it is spread in the ordinary way.

Nearly six months of work was required to complete the repair of Kelvin Bridge, which indicates the extensiveness of the task. No exact cost figures are available; but the contractor is said to be satisfied that the portable air plant and the associate air-driven tools have been the means of effecting considerable savings both in time and money. The work was under the immediate supervision of Mr. Gill, managing foreman for John Emery & Sons.



**Kelvin Bridge, in Glasgow, Scotland, was built in 1900, and after a quarter of a century of service it became necessary to repair this much used structure.**

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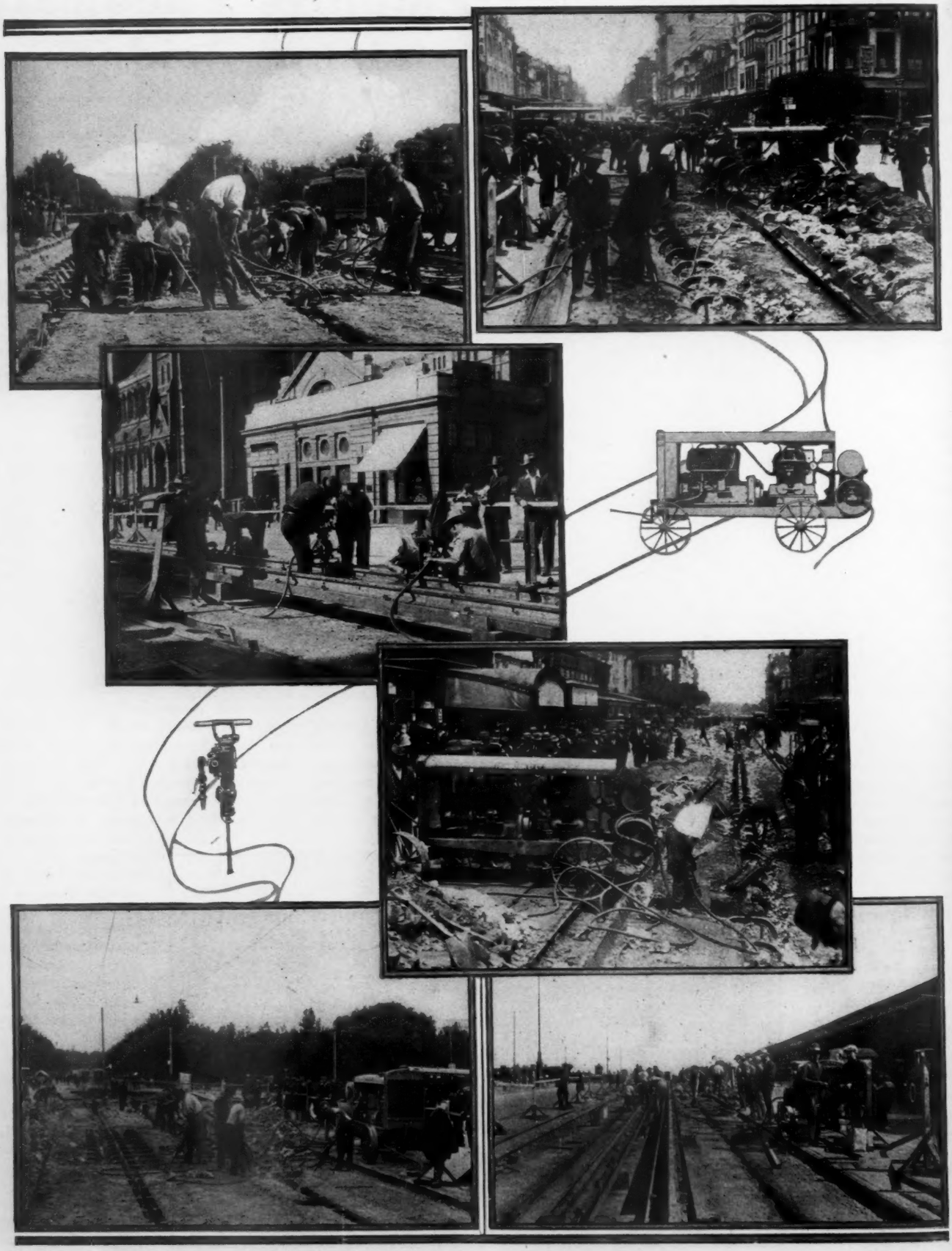
The world's production of copper in 1925 exceeded all previous annual records; and the consumption of that metal in the United States reached an unprecedented amount despite the fact that demand for it elsewhere was below normal.

## AMERICAN PORTABLE COMPRESSORS DO EXCELLENT WORK IN THE ANTIPODES



**Melbourne, Australia, with a population of 800,000, has recently transformed the tramway running through Swanston Street and thence to the seaside resort at St. Kilda by changing it from cable haul to electric traction. This has necessitated much excavating and other work in which portable compressors, and air-driven paving breakers, clay diggers, drills and hammers have played their part in hastening the completion of the task. From Melbourne to St. Kilda is a run of four miles.**

# Skillful Blast Taps Waters of Glacial Lake

## Isolated Waters on a Mountainside Were Thus Made Available For Parched Farmlands in the Valley Far Below

By C. H. VIVIAN

FAR up on the eastern face of the Colorado Rockies, over two miles above sea level, an absorbing drama in explosive engineering was enacted last summer. There, in a remote alpine setting close to that wavering line that marks the last outposts of timber life, with the vanguard of modern civilization far behind, dynamite ripped its way through a natural rock barrier and loosed the waters of a glacial lake that man might put them to agricultural usage in the fertile valleys beyond the last fringe of foothills below.

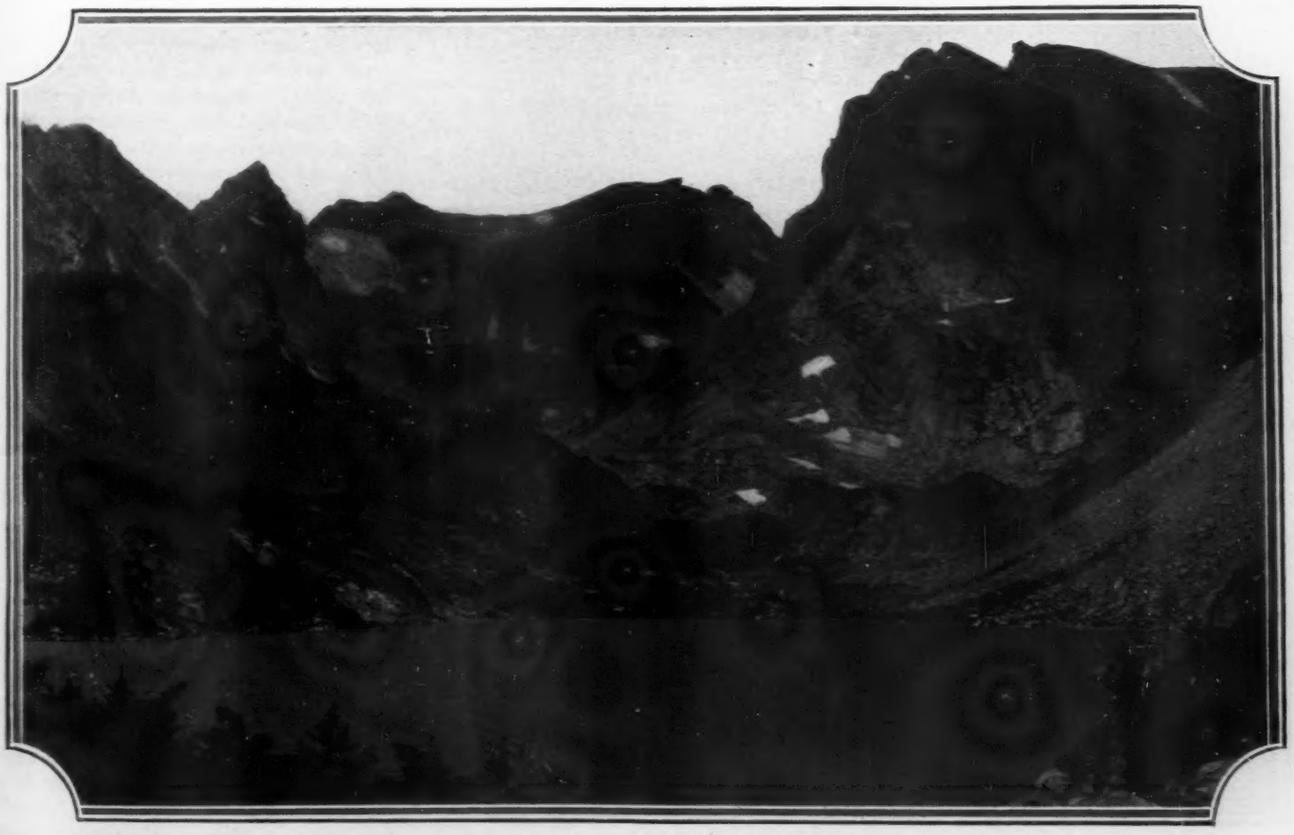
There, a civil engineer—turned explosive technician through force of necessity, and with little experience along that line to background his efforts—faced a problem in which helpful data were almost entirely lacking and yet triumphed through sheer engineering knowledge. It was a victory for individual application of technical theory that carried not a little satisfaction; for success came where others, seemingly better versed in the matters it involved, predicted failure unless the procedure were modified.

Then, too, there was much at stake. In the midst of a drought, farmers down on the plains were sorely in need of the water. It held life itself for their growing crops. Failure of the explosive to do its work would mean burnt up fields and considerable monetary loss. But an even greater hazard threatened—the danger that a too generous use of explosive might shatter the rocky barricade beyond the limits where the escaping water could be handled. In that case, thousands of tons of water would sweep down the narrow St. Vrain Canyon, snuffing out lives, effacing roads and bridges, and inundating scattered settlements. Last of all, there was the water itself to be considered. It was the treasure sought. For irrigation purposes it was worth $30,000 if distributed in such quantities as the valley ditches could handle. But if all of it were allowed to escape at once it would be a total loss, or even a liability that might pile up great sums in damages because of the water's devastating rush.

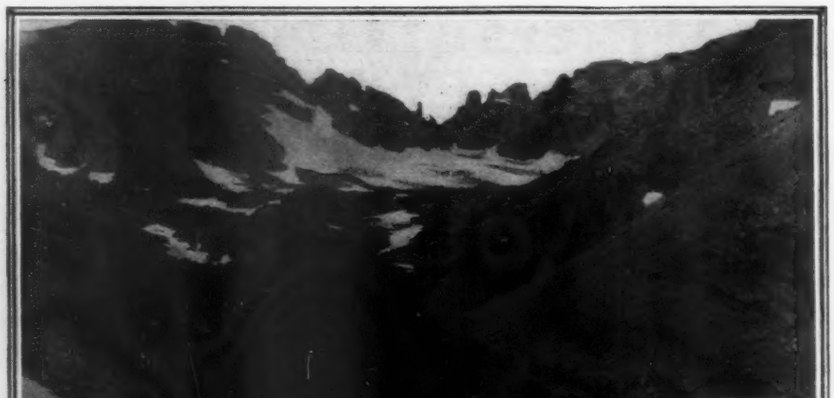
The scene of operations was Isabel Lake, approximately 50 miles northwest of Denver, in Boulder County. It is one of numerous bodies of water left hanging, as it were, on the eastern slope of the Continental Divide in the retreat of the great glacial ice cap that covered the entire region in former geologic eras. The higher reaches of all the bigger valleys exhibit chains of these morainal lakes. Isabel Lake is one of the largest of these bodies of water—its surface covering approximately 35 acres. It is fed by eternal snowbanks and also by Isabel Glacier, the dwindled remnant of the former ice mass that formed the valley.

In one respect Isabel Lake differs from the typical glacial lakes of the section. Most of them were created when the ice, in its retrogression, paused long enough for its terminal moraine to accumulate to such an extent that an embankment was thrown across the valley. The resulting dam is commonly an admixture of glacial-rock flour, sand, and gravel with boulders ranging up to many tons in weight.

It is apparent, however, that Isabel Lake was formed in a slightly different manner. A study of the geology of the district shows that a highly resistive syenite forms the valley floor at the point which represents the lake's forward or down-valley embankment. Soundings of the lake reveal considerable depth, and indicate that it was created by the gouging action of the ice while in forward movement. It is further



**The rugged setting of Isabel Lake, high on the shoulder of the Continental Divide, explains why so little has been generally known about this isolated body of water that has been tapped to vitalize farmlands in the valley far below.**



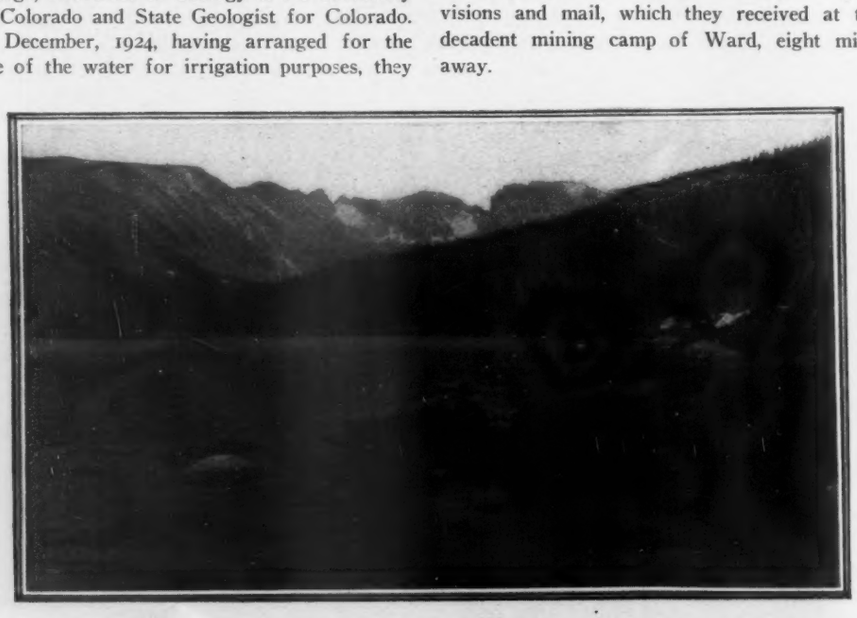
**Isabel Glacier as it appears in the summertime. This body of ice can be reached only by a very stiff climb over a circuitous route.**

evident that the glacier was unable to cut this syenite barrier, although it dug deeply into the rocks just behind. The result was the formation of a basin, with the waters firmly impounded by the syenite ledge.

The value of this and similar natural reservoirs was recognized many years ago, and steps were taken to utilize them. In 1910, the Boston-Colorado Power Company started driving a tunnel, from the down-valley side, which would tap Isabel Lake 30 feet beneath its surface and allow its waters to be used for equalizing the stream flow below. However, the company became enmeshed in financial difficulties and abandoned a rather extensive power-development project.

Fred A. Fair, engineer of Boulder, was employed by that company, and he saw the possibilities of the lake. Accordingly, he filed on it as a reservoir site, which he held through the succeeding years in association with Dr. R. D. George, Professor of Geology at the University of Colorado and State Geologist for Colorado. In December, 1924, having arranged for the sale of the water for irrigation purposes, they awarded a contract to three practical miners for the completion of the tunnel started fourteen years previously. It had been driven 100 feet out of a total distance of 465 feet.

The nearest road, even of the narrow, logging type, was three miles distant. Accordingly, the necessary machinery had to be taken in over the snow. A compressor, a gasoline engine, and 100 barrels of fuel oil were sledged along rough trails through the timber and over rocky ridges to the valley, where operations were located. There, advantage was taken of Long Lake, a lower member of the glacial series. It was a comparatively easy matter to skid the heavy materials across its frozen surface, after which they were sledged the remaining distance to Isabel Lake. With a radio set forming their sole communication with the outside world, the three miners began their work, while winter's snows added to their isolation. Every two weeks one or more members of the party came out on snowshoes for provisions and mail, which they received at the decadent mining camp of Ward, eight miles away.



**Long Lake, across which supplies were moved by sled in the wintertime to carry on work at Isabel Lake, two miles higher up on the mountain.**

At the altitude at which the work was in progress—10,727 feet, the compressor acted at less than 70 per cent. of its normal rating; but the 9x9-inch machine, driven by a 40-H.P. Novo gas engine, delivered adequate air to operate a BCR-430 "Jackhamer" mounted on a column. The pneumatic equipment also included a No. 33 sharpener that served to keep the drill steels in condition. Snow caused the only trouble. It accumulated to a depth of 20 feet, and on numerous occasions its weight broke the 1-inch air line which traversed 1,000 feet of open country to reach the tunnel portal. However, good headway was made; and by June the bore—5 feet across and 7 feet high—had penetrated to a point where the 1-inch pilot pipe, which was kept 6 feet ahead of the breast, showed a steady stream of water. This, together with measurements of the tunnel, indicated that the time had come to stop drilling.

One hundred and fifty feet in from the tunnel portal an upraise had been driven 50 feet to the surface. At the bottom of this upraise there was constructed a concrete box with its sides keyed into wedges cut into the rock. In this box was placed a 36-inch valve to control the flow through the tunnel. Difficulty in getting the 2,500-pound valve on the ground occasioned some delay, for with the snow and ice gone the transportation problem was complicated. In the end, a crude road had to be built for three miles. Once the valve was in place, everything was ready for the final and all-important step—that of blasting out the intervening wall of syenite which was holding back the lake water.

Directly above the breast of the tunnel was 50 feet of solid rock. That it was fractured little, if any, was fairly certain from the fact that the enormous pressure which had been exerted against it by the glacier of former days had failed to shatter it. During the winter's work, soundings had been taken through the ice, at 10-foot intervals, on a direct line with the tunnel for a distance of 50 feet out into the lake. These soundings determined the degree of slope of the inside of the syenite ridge. They also showed that the 6-foot rock wall was backed up by approximately 12 feet of mud and loose rock—making a total barrier of 18 feet to open water. The pressure to be overcome was estimated at 12 pounds to the square inch, or a static head of substantially 30 feet.

With these facts at hand, Mr. Fair attacked the job confronting him. Attempts to determine the amount of explosive required and the most efficient method of handling it by comparison with similar undertakings had led him up a blind alley. Only one analagous case was on record: In trying to break a tunnel through to a Montana lake, where the static head was 50 feet, 10 tons of explosive had been used and had failed to do the work.

From his study of this unsuccessful effort, Mr. Fair concluded that too much rather than too little explosive had been employed. He believed that the error lay in improper ballasting against the blast, while a Denver explosive engineer, who had been present at the Montana attempt, held a different view. Accordingly, the Denver engineer recommended a charge of not less than 6,000 pounds for the Isabel Lake

project. This was at wide variance with Mr. Fair's figures—he having decided in his own mind that 500 pounds would be sufficient. Influenced by the explosive handler's opinion, however, he modified his plans and used 750 pounds.

Knowing that his problem was to offset some of the enormous pressure exerted against the wall from the inside of the lake, he decided to create a water ballast by bulkheading the tunnel. The bulkhead had to be so placed that it would furnish the required resistance to the concussion and at the same time protect the valve. The site of this bulkhead was at a point 150 feet in from the valve box and 190 feet back of the breast. Prior to its erection, the explosive was placed at the breast.

A shelf or bench, 3½ feet high and extending back 5 feet, was constructed of gravel-filled sacks. On top of this and against the breast 650 pounds of gelatin-base, 40 per cent. dynamite was built up to a point near the tunnel roof and tamped solidly into place. Above this charge, and reaching to the top of the tunnel, was put 100 pounds of gelatin-base, 60 per cent. dynamite. A wall of gravel-filled sacks was then constructed to hold the charge in position. Into the charge ran battery wires with No. 8 caps and also Cordeau Bickford, which was carried back and forth several times among the loose sticks.

The bulkhead was composed of sacks of sand—the wall being two sacks thick. On the breast side, the sacks were laid endwise across the tunnel, while those on the portal side were laid just the opposite way—that is, the length of the sacks parallel with the tunnel line. Between the two layers was placed a canvas diaphragm with the flanges turned toward the tunnel portal and wedged against the wall on either side by the outer layer of sacks.

As the wall was erected, railroad rails, cut to length, were built into the outside face. These rails extended across the tunnel, being spaced every 18 inches from the floor to the roof. They were keyed into the rock walls and comprised the real strength of the bulkhead. With this structure in place, the chamber between the bulkhead and the breast was allowed to fill with water flowing in from the lake through the pilot pipe.

As the tunnel had a slope of 6 inches to 100 feet toward the breast, it was necessary to provide means for the escape of air from the top of the advance sections to insure the entire space being filled with water. To accomplish this, a 1-inch pipe, which had been fixed in place at the top of the tunnel, was carried from the breast up and through the top of the bulkhead. This also acted as a gage to show when the entire chamber had become filled.

When the chamber was nearly flooded it was found that the top of the bulkhead was not watertight. Accordingly, wooden stulls were placed near the top of the tunnel, thus enabling additional sacks of sand to be wedged tightly against the roof to stop the leakage. This done, a workman was stationed at the bulkhead with orders to fire the blast the minute water showed through the indicator pipe. After an all-night vigil he discerned a meager flow—at first a drip, and then a stream. Without waiting to notify any of the others, who were in a cabin several hundred feet away, he hurried to the battery outside the tunnel portal. The battery was a 3-pole machine controlling both the Cordeau and the caps.

When the plunger was sent home, there was an instantaneous response. A column of water, mud, and rocks was hurtled 200 feet into the air. A minute later, water, mud, and debris came rushing out of the tunnel portal. Mr. Fair, who happened to round the corner of the cabin just in time to witness the effects of the blast, rushed to the upraise and scurried down the ladder to the valve box. He found the valve intact and apparently uninjured.

Examination of the surface of the ground above the point of the explosion showed that a crack had been opened in the rock 15 feet back from the tunnel breast. Visible evidence of this was revealed by the fact that a boulder, estimated to weigh 15 tons, had been moved a distance of 6 inches toward the lake. Later, when the crack was examined in the tunnel, it was found to have opened there to a width of 8 inches.

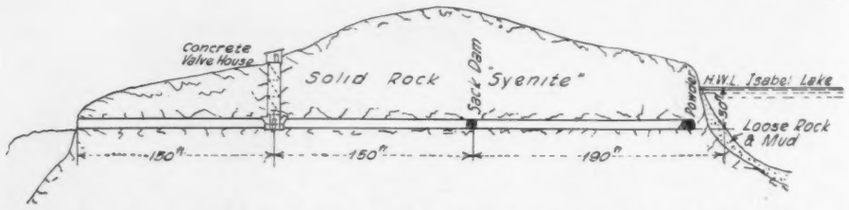
Last fall, after drainage of the lake down to the tunnel-floor level permitted inspection

**Isabel Glacier seen at close range. The glacier lies just below the crest on the east side of the Divide, and is the source of the water that flows into Isabel Lake.**

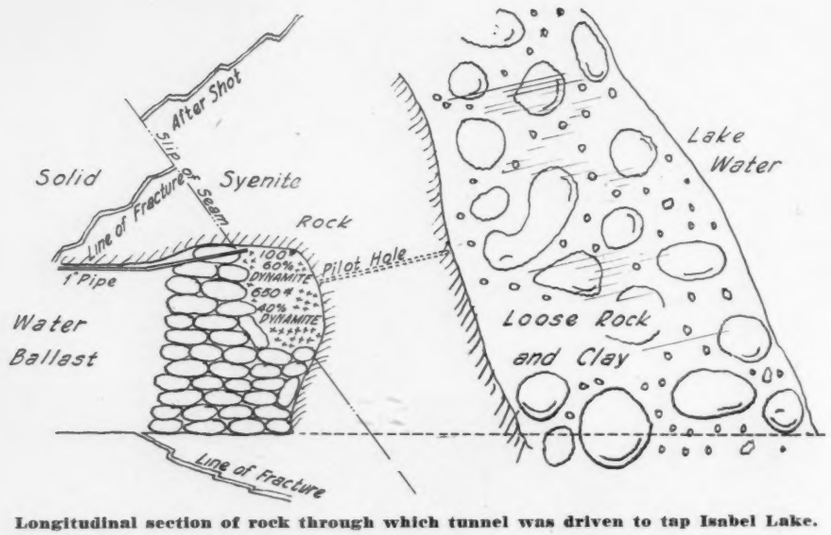
and cleaning, it was found that the rock had been broken out almost exactly along the desired lines. The downthrust of the blast was such that it had sheared off the bottom of the lake at a considerable angle from the horizontal.

happened. They were found on the tunnel floor —all having been bent into V-shape when blown from their sockets in the walls.

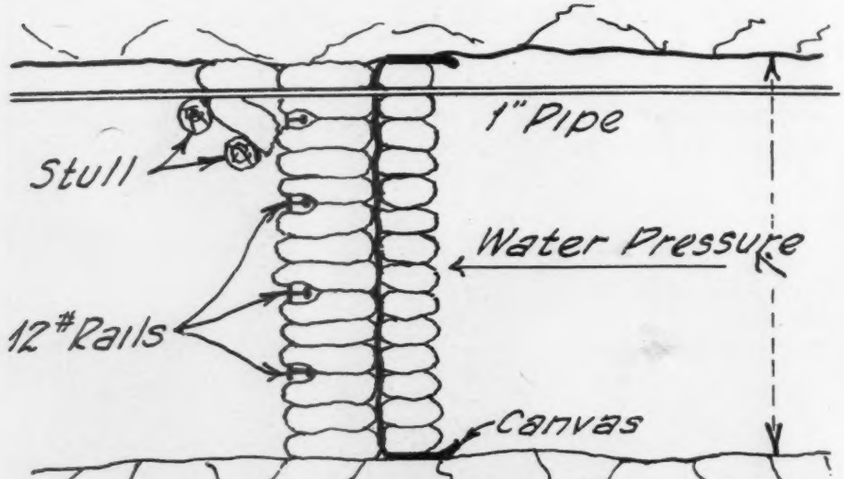
Mr. Fair's theory that the water ballast would act virtually as a solid, particularly if the explosion were quickened, proved to be correct. It was for the purpose of quickening the blast that the Cordeau and the 60 per cent. dynamite were used. The temperature of the water was 45°F. Calculations made prior to the shooting also led Mr. Fair to the conclusion that a 100-foot water chamber would be ample. No doubt this would have sufficed, though it was increased to lessen the chances of failure.




**Plan showing arrangement of powder charge by which the final break was made.**




**Longitudinal section of rock through which tunnel was driven to tap Isabel Lake.**




**Plan of sack dam that was erected in the tunnel.**

The crux of the entire problem, according to Mr. Fair, was the construction of the bulkhead. It had to be built in such a manner that it would withstand the pressure of the water and at the same time give way before the blast. Because of the danger of clogging the valve, no floating material could be used. This was the reason for the rails—it being figured that they would sink. That was exactly what

## IMPROVISED VISE OPERATED BY COMPRESSED AIR

A VISE operated by means of compressed air instead of the usual screw mechanism is described in a recent issue of the *American Machinist*. The vise was made up of available parts found in the railroad repair shop where it is used to grip firmly small round pieces to be drilled or otherwise treated. It consists of a fixed vise-jaw, firmly anchored to one end of a base plate, and of an air-brake cylinder attached to the other end. The movable jaw is connected directly to the piston rod of the air cylinder. So that oil or compound may readily be used when the machine is in operation, the whole outfit is set in a cast-iron splash pan; and the vise is so compact that it can easily be moved from point to point in the shop, as desired.

By opening a valve, compressed air is admitted to the cylinder which, in its turn, causes the piston to close the jaws that grip the work. To release the object, the exhaust valve is opened. The releasing is aided by a coil spring around the piston rod, which forces the movable jaws apart. It is said that the action of this ingenious vise is well-nigh instantaneous, and that its grip compares favorably with that of a screw-operated vise.

## ICE A BOON IN MANY WAYS

THE consumption of marketed ice in the United States during 1925, so *Refrigeration* says, amounted to about 1,000 pounds per capita. Offhand, this represents a tremendous volume of the refrigerant, but it becomes understandable when we recall some of the ways in which ice is used to add to our comfort and to gratify our palate.

Approximately 1,000,000 carloads of perishable foodstuffs were transported hither and thither in refrigerator cars last year. The delicacies of the West and the South; fish from the seas near and far; bananas and pineapples from the tropics; meats and vegetables from the country's extremes; and poultry and dairy products from farms scattered the nation over were made available in every market or food shop in the land.

Ice is no longer looked upon as a luxury—we consider it one of the necessaries of our daily lives; and its benefits are continually spreading so that the seasons in a sense are no longer marked with the dietary limitations of the past. The production of ice and the inducing of refrigerating effect have become purely mechanical accomplishments, and in this achievement the compressor is the indispensable prime agent in bringing about the necessary low temperatures. The transforming of mere energy into comforting conditions and the providing of an ampler dietary the year through are climaxes in refrigerating engineering that have so altered our accustomed lives that we cannot entertain the possibility of their withdrawal.

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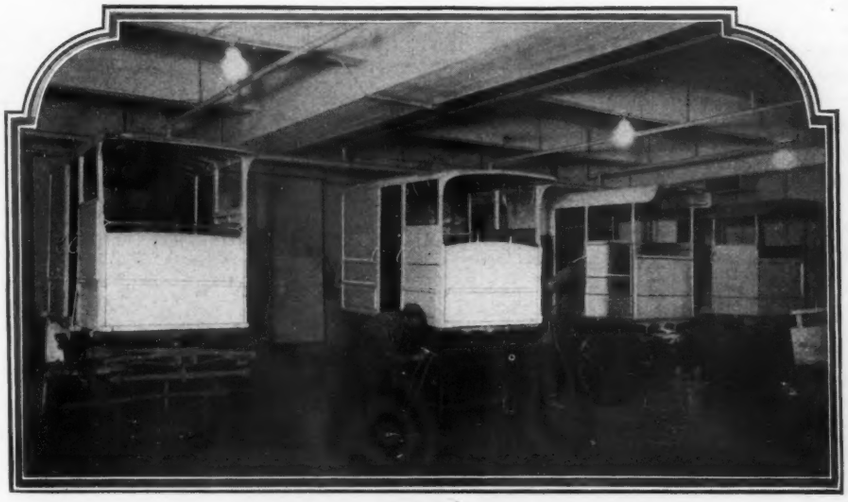
In the entire Union of South Africa there are but eleven street-car lines; and of these two are of the trackless variety.

# Air Brush in Dairy Service

By H. H. STARKEY

"THE old order changeth yielding place to new," wrote Tennyson in the last century. The present century is experiencing the fulfillment of his prophetic verse in a thousand ways. Large industries are continually utilizing innovations which tend to make their establishments function more efficiently. This is aptly illustrated by one of the largest purveyors of milk and other farm produce in New York City—the Borden's Farm Products Company, Inc., whose brightly painted wagons have traveled up and down the streets and avenues of the Metropolis for many a year. The particular change in this instance has been the discarding of the bristle brush in favor of the compressed-air-operated spray gun for painting the corporation's vehicles.



**Mounted and dismounted wagon bodies undergoing repainting by means of the spray gun.**

The enormous increase in business, due both to the growing population of the city and to the growing popularity of dairy products, has shown the company the wisdom of introducing this quick and efficient method of keeping up the appearance of its large fleet of trucks and wagons. That this aggregation is large can be realized when it is learned that about 250 trucks are needed to transport the loose milk, arriving each morning at the several railroad terminals, to the company's ten pasteurizing plants. There the milk is also bottled and thence taken to the 57 distributing stations where horse-drawn vehicles, numbering something like 3,900, carry the product to the cutomers.

The Borden's paint shop is located at 992 Gates Avenue, Brooklyn. From near and far the wagons and motor trucks come to be repainted in white, yellow, and red—the house colors of the concern. Until a short time ago the shop was sorely taxed in endeavoring to keep this vast array of vehicles in a spick-and-span condition. But since the introduction of the Eclipse air gun for spraying the paint on the bodies, wheels, and chassis, the work has been done quickly and efficiently without the hustle and bustle and fatigue of the old method.

The Eclipse air-brush system used consists of an Ingersoll-Rand 7x6-inch compressor driven by a 15-H.P. General Electric motor, of six 5-gallon air brushes, and of oil-and-water separators. The air supplied by the compressor is distributed to outlet points, along the wall, to the separators, which are connected to air-tight pressure containers by means of a 25-foot length of hose. The top of each of these containers is fitted with two sets of reducing valves, gages, and outlets for air and material fed to the guns. One of these reducing valves regulates the air pressure to the container and controls the flow of material. The pressure is usually between 10 and 30 pounds, and depends upon the viscosity of the paint and the speed of the operator. The other reducing valve regulates the air pressure used for atomizing the material in the nozzle of the gun. This pressure is usually between 15 and 40 pounds, depending on the paint to be atomized. The finish and the speed of operation are exceptional.

When a wagon arrives for renovation from one of the distributing stations, it is set up on a trundle, and the wheels are removed. The old paint is then burned off with a gas torch, after which the surface of the wagon is thoroughly cleaned by a jet of compressed air under a pressure of from 80 to 100 pounds. Next, the wagon, on the trundle, is wheeled to the paint room. This room measures 75x60 feet; and by means of four electric fans is provided with a continuous supply of fresh air. As an added protection when painting chassis, the workmen are equipped with breathing masks. This is necessary when a number of spray guns are in operation at one time.

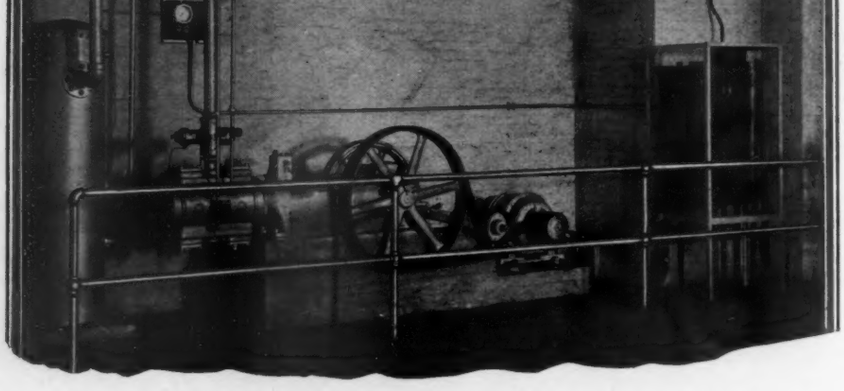
By the spray-gun method of painting, the prime coating is applied to the body of a wagon in from four to five minutes—approximately one-sixth the time that a workman using a hand brush would take. The painting of the chassis consumes slightly more time, due of course to the necessity of reaching all corners and crevices. Because the application of paint by means of an air-spray gun covers a surface much more thoroughly than it is possible to do with a bristle brush, two coats of paint are saved. When the wagon is ready to receive the final coat of enamel, the air pressure is increased from 40 to 90 pounds. This obviates the need of thinning the enamel, and at the same time assures a thick glossy finish.

In order to keep up with the pace set by the workmen using paint-spray guns, the shop is equipped with a drier—a large oven-like compartment in which five

**Paint spraying the wheel of a milk delivery wagon.**

wagons can be accommodated at a time. Here, the vehicles, subjected to an electrically regulated temperature of 110° F., are thoroughly dried in two hours. From the oven, the wagon is returned to the paint room, where it receives its final embellishment. This takes but a few minutes, and only involves transferring the familiar red letters and figures, seen on all Borden's rolling stock, by decalcomania paper. The newly painted wheels are now replaced; and the wagon, ready to be dismounted from the trundle frame, is again fit for service.

With the equipment employed, an average of 200 wagons and trucks are turned out each month, where previously, by hand methods, an output of 100 was considered an excellent performance. In short, the substitution of the paint-spray gun, utilizing the power of compressed air, has doubled the efficiency of Borden's paint shop.



**The I-R compressor which supplies air for the spray guns in the Borden paint shop.**

## MAGNITUDE OF AMERICAN BRICK INDUSTRY

BRICK is the supreme and unique building material, because it is still in the lead even though it is the oldest known product of its kind. It is to this day made of clay, as it was at the first; but its production is not by the manual toil of slaves but by the most efficient and, what might be called, prolific of mechanical equipment. The following astonishing figures relating to the industry were presented in a recent paper by A. H. Bickerstaff before the Rotary Club of Columbus, Ga.

In 1925, approximately 10,000,000,000 bricks were produced in the United States, and in their making 30,000,000 cubic yards of clay and shale were required. The coal, or its equivalent, needed in their burning amounted to about 3,000,000 tons. We know how cement appears to dominate the industries today, and yet there is considerably more capital invested in the manufacture of brick.

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In transporting light merchandise and passengers from Arabia, India and Persia to Mecca, the time-honored camel can no longer compete with the automobile.

## AIR-DRIVEN WASHER FOR ELECTRIC LOCOMOTIVES

AT the Chicago, Milwaukee & St. Paul Railroad shops, at Deer Lodge, Mont., there has recently been developed a frame washer designed especially for cleaning the frames of electric locomotives—the washing mechanism usually employed for this work on steam locomotives not being adaptable to types of electric equipment where the motors are so situated that water may enter and injure them.

This washing outfit, which depends on compressed air for its operation, consists of a large drum, mounted on two wheels, and of a number of pipe connections. It is equipped with a reducing valve, a gage, two globe valves, a filling cock, and necessary hose connections.

The portable machine is operated in the following manner: Compressed air is admitted into the drum, which is filled with a washing fluid. The pressure on the surface of the liquid forces it upward through a pipe extending to the bottom of the drum; through a globe valve; and thence through a choke consisting of three 1/64-inch holes. Orifices of this size have been found to control the fluid satisfactorily—that is, to give just the right spray, without any other regulation. But before washing a frame it is first dusted with a jet of compressed air. This is made possible by simply closing the valve which permits air to flow into the drum and by opening the valve directly connected with the compressed-air line. After the dust has been blown from the frame, the valve admitting air into the top of the tank is opened, and the liquid, thus induced to flow, mixes with the air in the tee just ahead of the air-regulating valve. By this method of washing, the dirt is sufficiently cut. After one section of the frame has been treated in this way the flow of the liquid is shut off, and the accumulated dirt and cleaning fluid are removed with compressed air.

It has been found that this air-driven washer enables one man to clean both sides of the frame of an electric locomotive in two hours. Previously, five laborers, using 20 pounds of cotton waste and 2 gallons of kerosene, were needed to do the work in the same time. The solution employed in the washing machine consists of one pint of kerosene, or mineral seal oil, and one pound of soap to each gallon of water—the mixture being boiled before it is put into the drum. The cost of the solution is but three cents a gallon.

## GAS MAIN CLEARED BY AIR AND ELECTRICITY

NOT long ago, it was discovered that a 3-inch high-pressure main, feeding gas from Burlington, Vt., to the low-pressure system of the Village of Winooski, in the same state, had become clogged by an accumulation of tar that had hardened. The problem was how to get rid of the obstructing mass so as to restore the distributing line to service with the least possible delay. It was finally decided that the work could best be done by the combined use of electricity and compressed air.

After inserting risers at several points, according to *Gas Age Record*, the principal obstruction was located between two neighboring street corners, some 700 feet apart. A bank of alternating-current transformers was set up between these two points, and a current of 400 amperes at 220 volts was discharged into the pipe together with compressed air at a pressure of 80 pounds to the square inch—a portable compressor having been brought to the scene for the purpose.

In less than an hour, the riser at the lowermost end commenced to emit a string of tarry matter which had become sufficiently warmed by the electric current to enable it to slide under the propelling force of the compressed air. The main was thus handled in sections; and after several hours there had been discharged a total volume of solid matter equal to one-third of the total content of the 700-foot length of line. Some solid pieces of tar 15 feet in length and filling the entire diameter of the pipe were driven out. The gas main was thus cleared in short order—the process preventing the extensive digging up of the street, which had been newly paved.

## BUSINESS INFLUENCED BY WEATHER FORECASTS

IN an address, recently delivered before the New York Board of Trade and Transportation, Mr. James H. Scarr, Senior Meteorologist of the United States Weather Bureau in New York, made the statement that ice-cream manufacturers are guided to a great extent by weather forecasts in determining the amount of ice cream to produce from day to day.

Mr. Scarr's office receives hundreds of calls daily from firms and individuals that find a foreknowledge of the weather of vital importance to their business. Sportsmen, railroad companies, and shippers of perishable goods are but a few of the many that are influenced in one way or another by the daily forecast of Uncle Sam's meteorological experts.

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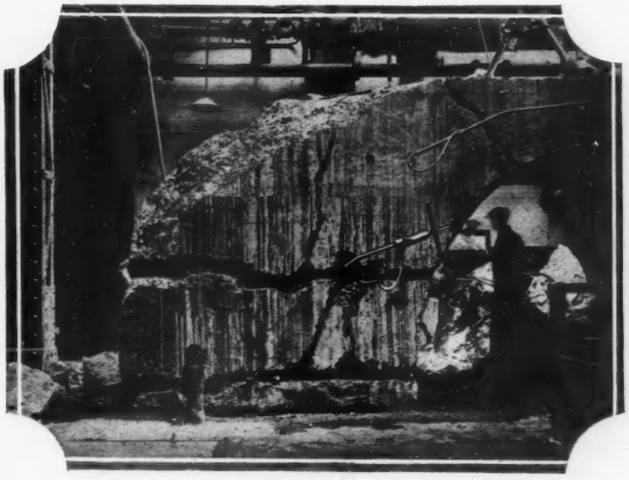
Sao Paulo, with a population of more than 700,000, is not only the leading industrial center of Brazil but of the entire southern continent.

# Shattering With Air And Water

By J. MENZIES

IN these days of hustle, any device or invention that will increase speed of operation and reduce physical effort deserves mention. When analyzed, every mechanical invention is found to apply in one form or another Nature's forces or materials. Probably one of the earliest mechanical contrivances designed by the wit of man was the primitive bow and arrow, which primarily depends for its efficiency upon the natural flexibility of wood. Similarly, water and air have both played large parts in man's utilization of natural forces for his own betterment; and it follows that many further uses for these elements will occur to the minds of this and future generations. Therefore, it will no doubt be of interest to our readers to learn of an ingenious application to which water and air have been and are being put, namely, in the demolition of mass materials without shock or dust.

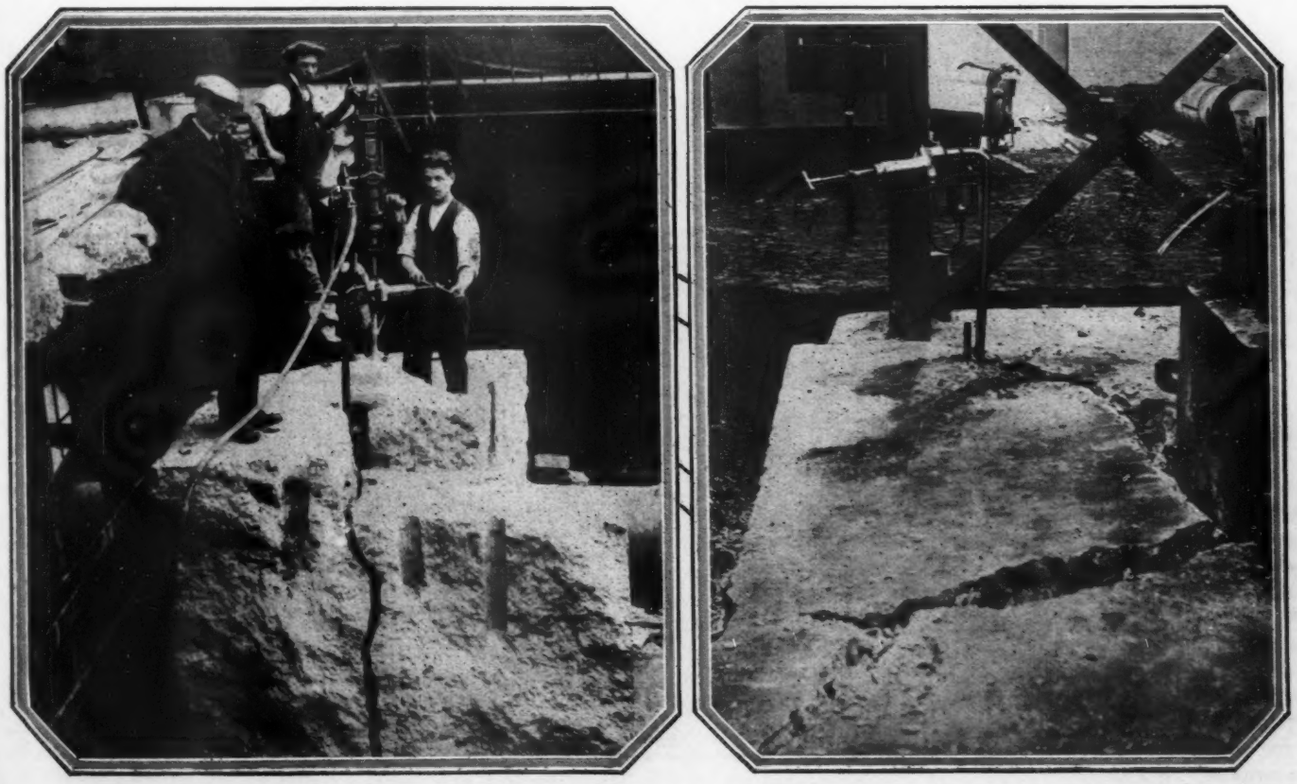


**Breaking a 50-ton mass of concrete with hydraulic cartridges at the Lots Road Power House, London, England.**

Recently, the Electricity Department of the City of Birmingham, England, in order to meet the growing demand for electricity, found it necessary to install a larger-capacity plant in their Summer Lane Power Station. This called for the removal of obsolete engines, together with their concrete foundations; and it was in the breaking up of the foundations that the new method referred to was employed.

Everybody knows how essential it is that all running machinery should be kept in as dustless an atmosphere as possible, and nowhere is this more essential than in a modern power plant where extremely sensitive pieces of machinery operate at very high speeds. Consequently, on placing the contract for the removal of the foundations with the Demolition & Construction Company, Ltd., of London, the Electricity Department was careful to stress the need of preventing dust or shock of any kind.

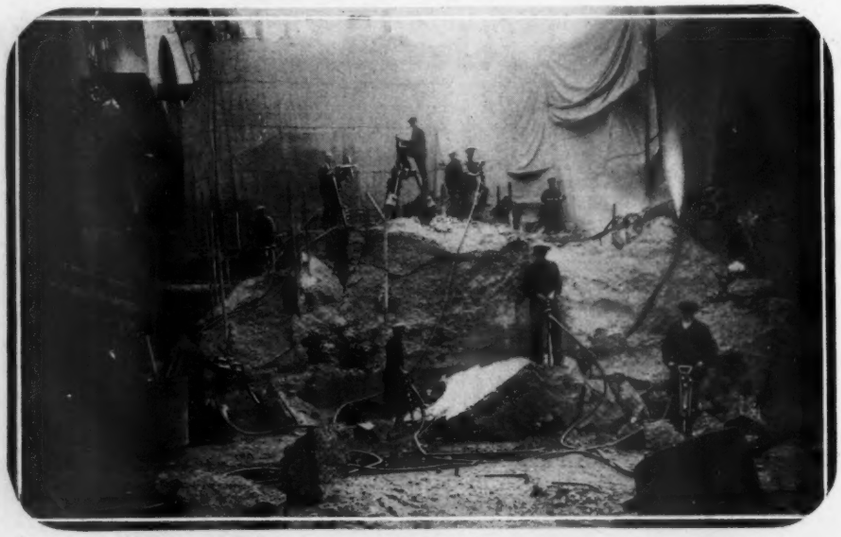
In order to clear the sides of the concrete beds, a considerable amount of flooring, one foot thick, had to be broken out. Pneumatic paving breakers were brought into use for this part of the contract; and as most of our readers are familiar with these tools and the work which they are accomplishing everywhere, no description of them need be given. It was, however, also necessary to take out about 60 steel joists which were embedded in the foundations at one end and sunk into a brick wall at the other. The method adopted for removing these was interesting. The ends which were fast to the foundations were first cut loose and shackled to an overhead traveling crane. By raising and lowering each severed



**Excellent examples of typical breaks produced by the shattering or the expansive action of hydraulic cartridges placed in holes drilled in massive foundations.**

joist once or twice, the end remaining in the brickwork was loosened and the crane was then able to draw it out readily without damaging the wall in any way. To an eyewitness, the operation was rather reminiscent of painful moments in a dentist's chair.

When the joists had all been disposed of, the actual demolition of the foundations was started. For this phase of the work the contractors employed their patent hydraulic cartridge, which, as the name implies, is a device which takes advantage of the properties of water to make it effective. The cartridge consists of a strong steel, cylindrically shaped body with a number of small chambers containing pistons or rams at right angles to its axis. These chambers are interconnected by means of a small capillary boring which, in turn, is connected to a small hand force pump by a short length of hydraulic pipe. The diameter of the cartridge varies according to the pressure required; but for general purposes a 3½- or 4-inch cartridge is found to be ample.



**A stage in the foundation demolition work at the Summer Lane Power Station, Birmingham, England.**

Vertical holes from 4 to 4½ inches in diameter were drilled along the surface of the foundations, about 3 feet back from the side or face, by the Ingersoll-Rand "Sergeant" type of reciprocating drill. A hole of this diameter sounds as though it might be a difficult proposition for any pneumatic drill, but the contractors stated that with the "Sergeant" drills no difficulty whatever was experienced; and in spite of the fact that the concrete was of a very hard nature the average time taken per hole was only fifteen minutes.

In each of these holes a hydraulic cartridge was inserted and wedged tight by liners or packing so that the full travel of the pistons could be counted upon. The hand pump was then brought into operation to force water down the hydraulic pipe and beneath the pistons, which, being made watertight by means of leathers, moved outward and thus transferred the pressure applied by the pump to the concrete. As a result, the concrete soon cracked and fractured audibly—making a sound much like a heavily booted foot on a gravel walk. In spite of the fact that the final pressure was in the neighborhood of 10 tons to the square inch, no shock of any kind was felt.

This application of hydraulic pressure eventually led to the breaking up of the concrete foundations into from 1- to 2-ton pieces. These were carefully lifted and slung by the crane to a clear space nearby in the basement, where they were reduced to hard core by the pneumatic plug-and-feather method to facilitate removal from the power station. For this work, holes about 1½ inches in diameter were drilled to a depth of 2 feet—BAR "Jackhamers" being used on account of their lightness, and into these holes were placed tapered feathers, two to a hole. Between each pair of feathers, a tapered plug that had been previously greased was driven by a paving breaker—this wedging action tending still further to fracture the concrete. This process was continued with the aid of paving breakers until the blocks were of such a size that they could be loaded into tipping wagons by hand labor. Three shifts of six men each were employed, so that the work could be carried on well-nigh uninterruptedly. The total quantity of concrete broken up and removed amounted to nearly 800 cubic yards, while from start to finish the job took nine weeks.

Engineers who have undertaken the demolition of mass materials will appreciate the speed with which the work was carried out, particularly in view of the small number of men required. Still more striking examples, however, can be cited. For instance, a solid foundation of 960 cubic yards was completely broken up and removed some time ago in three weeks and four days, the same type of plant and about the same number of men and shifts being employed.

The use of the hydraulic cartridge, is, of course, not confined solely to power stations and engine rooms. Much work has been done by the aid of this instrument of demolition on docks, harbors, reservoirs, etc., where the advantages of speed and safety make it especially suitable. Such was the case at South Shields, where the nose of an old graving dock had to be taken out to build an extension that would enable the owners to deal with larger ships. Pressure of business necessitated that the work should be carried out as quickly as possible, so the hydraulic cartridge was called into service. In six weeks the wall had disappeared; and it was found practicable actually to continue to repair ships while operations were in progress.

**Hydraulic cartridges proved effective in breaking up a 75-ton block of concrete in the Deptford Power Station, London, England.**

The breaking up of the concrete ballast in the blocking craft at Zeebrugge, shortly after the close of the World War, was perhaps the most interesting piece of work undertaken with the hy-

draulic cartridge. It was found impossible, when the time came, to remove the sunken ships—that is, to raise them bodily by means of cranes. The attention of the Admiralty was then drawn to the hydraulic cartridge, which was tried and proved capable of breaking out the concrete without damaging the hulls in any way. The holes were drilled under water by reciprocating drills—compressed air being supplied from an Admiralty boat alongside. The cartridges were inserted in the holes by divers, while a long length of hydraulic piping enabled the pump to be operated from a raft on the surface. In this way the concrete was eventually broken out of the hulls, which were then raised by the admission of compressed air.

**In removing the nose of a concrete graving dock at South Shields, England, rock drills and hydraulic cartridges were used to prepare the way for an extension of the dock.**

## IMPORTANT MARITIME AID ON PACIFIC COAST

THE new light and fog-signal station at Point Vincente, Calif., recently placed in commission, is an important aid to all shipping along the Pacific coast of the United States. Statistics, covering Los Angeles Harbor alone, indicate a traffic of more than 27,000,000 tons annually.

The fog signal consists of a 10-inch chime whistle, sounding a group of 2 blasts every 60 seconds, operated by compressed air. This whistle, according to the United States Lighthouse Service, is most efficient; and, under average conditions, can be heard three miles distant. The light is of 800,000 candle power, and is 185 feet above water level.

## COOLING THE AIR IN DEEP MINES

ONE of the most serious conditions with which the miner has to contend as he penetrates deeper and deeper into the earth's crust is that of rising temperature. Undoubtedly, the increase in temperature as he sinks lower must ultimately bar him; but still the determination is to venture as far down as possible.

The shaft of the Village Deep Mine, in the Witwatersrand, has already penetrated to a vertical depth of 7,000 feet, substantially a mile and a third; and the toilers there have told something of what they have learned thus far as to the likelihood of reaching greater working depths. An interesting paper on this subject, dealing especially with conditions encountered in the Village Deep Mine, was read recently before the Chemical, Metallurgical & Mining Society of South Africa.

In that mine, a point is being approached where ventilation or mere air movement no longer avails. When a nearly saturated atmosphere mounts to the temperature of the human body, 97.5°F., it becomes impossible to work in it, and means of cooling the air must be employed. At the Village Deep, ice is used to cool the air delivered to the headings by the 15-inch ventilating pipes, while chilled water is sprayed into the warm air which passes into the winzes from the development areas.

The results obtained are said to be promising, and will doubtless form the basis of further study in the use of cooling mediums or apparatus. The situation, as the authors of the paper point out, "is just another phase of mining upon which we are entering. It is being tackled, and will undoubtedly be overcome as other problems have been solved in the past."

## FIRES CAUSED BY HUMAN "SPARK PLUGS"

WE are all possible "spark plugs"—some of us more so than others. With a room cold and dry, shuffle your feet across the carpet while someone else turns on the gas. It may be that you can ignite the gas with the tip of your finger. *Fire Engineering* cites several instances of fires started in this way.

At a shoe factory, a woman—passing leather soles between two rollers, the lower one of which was wet with a solution of rubber in naphtha—on several occasions set fire to the tank with a spark from her fingers, once receiving serious burns. Another operator who was substituted in her stead had no such trouble. Again, at an automobile-tire factory in Canada, a workman was pushing a truck along the floor when a spark from his hand fired a gasoline tank. In the excitement that followed, the tank was overturned and so spread the fire that 168 automatic sprinklers were set in operation. The total loss amounted to $50,000.

Solvents of rubber are highly volatile and readily form explosive atmospheric mixtures in their neighborhoods. No safety precautions should, therefore, be overlooked in such circumstances.

Approximately 5,000,000 tons of ice are consumed annually in New York City.

## SOMETHING NEW IN POWER SHOVELS

THE advantages of mechanical over hand mucking are so well known that the value of mechanical mucking machines is no longer questioned. Mine executives are rapidly turning to modern methods of handling ore and rock underground as one means towards a reduction in mining costs. The difficulties heretofore have been the lack of a moderately priced, simple, efficient machine that could be easily handled and moved from place to place and yet meet the requirements of different methods of mining, whether working in narrow drifts and tunnels, or in large rooms or stopes. To fill this much-needed want, the Nordberg Manufacturing Company, which needs no introduction to mining men, has recently put on the market what is known as the Butler shovel, which was designed especially with the aforementioned conditions in mind.

**Some striking views of the air-driven Butler mucker in action.**

Briefly, the Butler shovel is of the full revolving type—loading cars at either side or at the rear, as may be desired. It functions not unlike the well-known steam shovel, but is operated by compressed air. According to the manufacturer, one of the outstanding features of the machine is its low air consumption, which will not exceed 135 cubic feet per minute at 70 to 90 pounds pressure. This economy in air consumption is made possible by the manner in which the air is utilized and by the corect proportioning of the various parts. The pressure of the air acts upon a single thrust cylinder, the direct thrust thus exerted giving a better leverage to the power movement and resulting in a material saving in air. When mechanical loading equipment of this type is installed, and additional compressor capacity must be provided, the use of a smaller compressor not only means less expenditure for equipment but lower cost for power.

The compact design of the Butler shovel permits its employment in drifts 5½x7 feet, while its wide clean-up of 18 feet makes it suitable for service in large tunnels, stopes, and rooms. It will dig below grade in any direction, and load cars 48 inches or higher, if necessary. Its ¼-yard dipper operates at a speed of 3½ passes a minute, giving the shovel a capacity, under ordinary working conditions, varying from 15 to 30 tons an hour. This, of course, depends entirely upon the circumstances under which the shovel must operate, and especially upon the car service that can be maintained.

The two controls for the shovel's movements are conveniently located. In operating the shovel, one hand is on the lever controlling the rotation—the movement of the lever being always in the same direction as that in which the revolving member is to move. The other hand is on the lever of the operating valve which controls the movements of the dipper. The various points to which the lever is shifted follow in their natural sequence, thus permitting a new operator to manipulate the shovel without difficulty.

The weight of the shovel is but 4,000 pounds; and because of this lightness it can be readily transported about a mine on its roller-bearing wheels. It can be placed on a 36x54-inch mine cage without dismembering, but the operator's platform—extending 12 inches from the side of the machine—can be unmounted if it be desired to move the shovel through still closer quarters.

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The first large power development in British Malaya is soon to be undertaken, and will involve the construction of a hydro-electric plant on the Parak River. The plant is to have a capacity of 18,000 kilowatts; and the current is to be transmitted for use in the native tin-mining area.

## VALUE OF SCRAP RUBBER IN TIRES INVESTIGATED

THE use of reclaimed rubber in the treads of pneumatic tires is being investigated by the United States Bureau of Standards, and the results so far obtained show that treads in which 25 per cent. of the normal rubber content had been replaced by reclaimed rubber gave an average service of about 7,000 miles on the road. Further experimentation, involving different grades of reclaimed rubber and different compounds, probably will lead to still better results.

The Bureau is planning to carry out a similar investigation looking towards the use of reclaimed rubber in the carcass of tires. The carcass is the part in which the design is most exacting and in which a small change may have a large influence on the tire's life. For this reason manufacturers have hesitated to utilize any material other than new rubber. However, because of the high cost of new rubber, considerable research work is being carried on with a view to replacing some of it with reclaimed rubber.

Preliminary dynamometer and endurance tests of tires manufactured in this manner indicate that the use of reclaimed rubber may be entirely feasible. But it is apparent that the incorporation of reclaimed rubber in a scientific manner is of great importance, and that careful consideration must be given to the proper balancing of the various ingredients of the compound. Inasmuch as the carcass contains a large part of the rubber that goes into the make-up of a tire, a very great saving in new rubber would result from the substitution of even a small percentage of reclaimed rubber.

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The Federal Government of Australia has announced its intention of appropriating a sum of £25,000 to aid prospecting in the Commonwealth for oil and precious metals.

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Exports of industrial machinery from the United States in 1925 totalled almost $150,000,000—an increase of 14 per cent. as compared with 1924.

# Canada's Convention of Mining Men

## Impressions of the Recent Meeting of the Canadian Institute of Mining and Metallurgy

By S. J. COOK*

IN spite of the recent pronouncement by a New York City daily that "Canada is a land where the men are ice-bound and the women are fancy skaters," upwards of 300 persons wended their way to Montreal, the commercial metropolis of Canada, to attend the 28th annual meeting of the Canadian Institute of Mining and Metallurgy some weeks ago. To an American, 300 persons may seem a small number to attend a convention, but those who think so have not been to a meeting of Canada's mining men. More types are to be found there, perhaps, than at any other convention of the kind held elsewhere. Everything is different.

Photo. National Resources Intelligence Service.

**This photograph of the Royalite oil well was taken after dark, with the scene illuminated by the flaming gas issuing from the well.**

To begin with, Montreal is most intriguing to the imagination. Known in history as far back as 1535 as the Indian Village of Hochelaga—with a population of 1,500 souls, it was named Ville Marie by its official founders in 1642. Subsequently, by common consent, it was called Montreal after Mont Royale which lies behind it, and the city now has a population of nearly 1,000,000 persons. But there may yet be seen much evidence of those earlier days: parts of the city and many of its people still reflect the early French regime. Such surroundings provide a splendid background for a convention of mining men. Representatives of a pioneer industry, they nevertheless are closely associated in so many ways with the activities of modern commerce that they form a link between the present and the past.

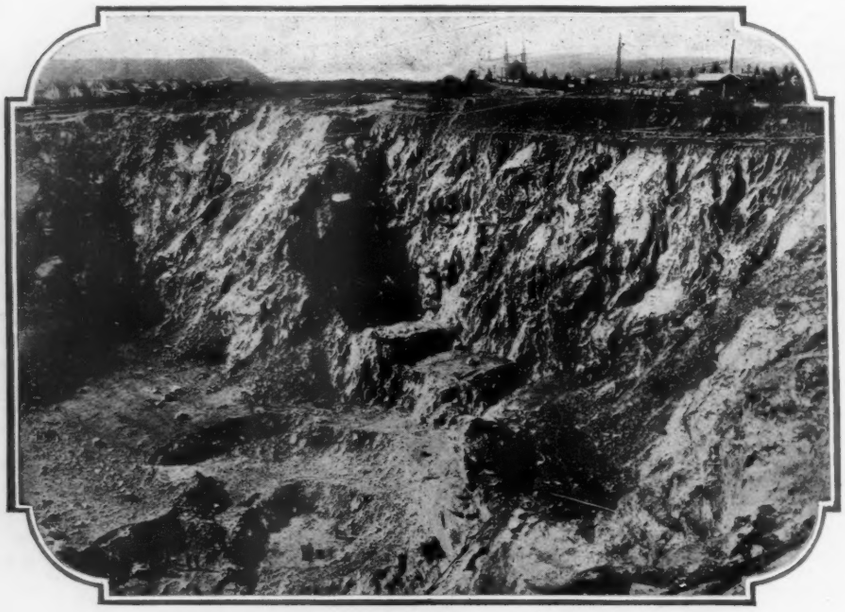
Quaint, indeed, was the greeting sent to the miners by the Mayor of Montreal: "I cannot give you the keys of Montreal, for here the doors are never closed." And with this message in their ears the delegates to the 28th annual meeting of the Canadian Institute of Mining and Metallurgy settled down to business in the historic old hostelry, the Windsor Hotel, within whose precincts Canada's parliamentarians for years met their friends and discussed their plans. Nor has this phase of getting together entirely passed. Prospectors, mining engineers and geologists, mine and smelter operators, professors of mining and metallurgy, representatives of the investigational branches of the mines departments of the several provinces and of the Dominion, look around eagerly for the friends and acquaintances they are wont to meet on such occasions. Men from the North country, whose one touch with civilization is the annual mining meeting, greet geologists and engineers who have summered in their country; men from the provinces renew acquaintances with industrial executives and federal government officials; and university students stand around in little groups, edging in here and there to hear some point of interest discussed.

After the opening formalities, the Institute devoted a part of the first morning to a consideration of the year's progress as revealed in the statistics presented by Dominion and provincial officers. This feature impresses the visitor. Every twelvemonth a report on mining statistics is presented at the annual meeting. It is a pretentious bulletin, running into 48 pages this year, showing in text and tables the details of production, and imports and exports of Canada's 80-odd primary mineral products. Each provincial government also presents a review of the industry's progress within the confines of the province. These latter reports are supplemental to the conspectus provided by the Dominion. Excellent coöperative arrangements exist among the provinces and with the Dominion government so that duplication and overlapping are avoided. Efficiency is the keynote of the organization.

**Section of the much discussed Red Lake District, the scene of Ontario's latest gold rush.**

In the afternoon there were read two informative but noncontentious papers—one on portable gas-driven mining plants, by F. A. McLean of the Canadian Ingersoll-Rand Company, Ltd., and the other on explosives, by E. Godfrey of Canadian Explosives, Ltd. But the item of chief interest during that session was the paper on *Canadian Mineral Resources, Limited*, by C. M. Campbell, mining engineer of Montreal, who is associated with the American Metals Corporation. Campbell's paper was

*Chief of Mining, Metallurgical and Chemical Branch, Dominion Bureau of Statistics, Ottawa.



**An asbestos mine in the famous Thetford District, Quebec, Canada.**

really a rebuttal, in part at least, of the presidential address delivered two years ago by Dr. C. V. Corless, managing director of the Mond Nickel Company's Canadian works at Coniston, in the Sudbury area of Ontario. Doctor Corless had developed a thesis on resources of the pre-Cambrian age, which found wide public favor. But Campbell, dour and honest Scot, thought some of the statements made were a little too optimistic. So he set himself the task of correcting what he considered the erroneous impression. For plain speaking and hard hitting, Campbell left little to be desired. He is an engineer of standing in Canada; apart from his somewhat pessimistic outlook he is well liked; and his ability as a scout is not questioned. Another Campbell, "Archie"—familiarly known as the "Duke of Argyll," entered the lists against his clansman after recalling that the Campbell clan dates back to 400 A. D., and the battle was on. Then came Dean Goodwin, the soul of good will. In his paper, on *A Stock-taking of the Profession*, the genial dean warmed his hearers back into the spirit of good-fellowship, that he has spent the greater part of his life in cultivating; and, drawing on his illimitable fund of reminiscent anecdotes, he even managed to chastise Mr. Campbell mildly, to that gentleman's very evident appreciation.

One of the charming features of the Canadian meeting is always the popular lecture, and this year's contribution was made by Dr. Frank D. Adams, Emeritus Dean of the Faculties of Applied Science and Graduate Studies, and Logan Professor of Geology at McGill University in Montreal. Last summer Doctor Adams paid a visit to the gem districts of Ceylon and Burma. This trip provided him with the necessary material for a most interesting travel talk, which was illustrated by many lantern slides. Doctor Adams' inimitable lecture style, coupled with his profound knowledge of geology, enabled him to present an address which held the closest attention of his audience for nearly two hours.

At the beginning of the next morning session, and it may be noted that all the meetings were run on schedule time, Frank E. Lathe, assistant to the president of the National Research Council, presented a number of research problems of interest to the mining and metallurgical industries. Mr. Lathe's experience with the Chile Exploration Company, the Granby Consolidated Mining, Smelting & Power Company, and the British America Nickel Corporation stood him in good stead when he undertook to point out a few of the mining and metallurgical problems awaiting solution. Some of the points he stressed were: storage of coal; production of high-grade fuel from low-grade lignites; methods of reducing cyanide consumption in the metallurgy of gold and silver; fuel efficiencies in copper and nickel blast-furnace practice; the use of sponge iron; increased efficiencies in roasting and reverberatory furnaces; possible further advances in hydrometallurgy of zinc and copper; the problem of refractories; and possible improvements in accounting practice relating to mining and metallurgical operations. This paper was followed by another, also relating to research, presented by R. S. McCaffrey, Professor of Metallurgy, University of Wisconsin, Madison, Wis. Professor McCaffrey outlined a practical scheme for coöperative research work between the university and the industry.

A paper of some literary and historical value, as well as of general mining interest, was that presented by Dr. Charles Camsell, Deputy Minister of the Dominion Department of Mines, on the subject, *The Influence of Minerals on Canadian History and Development*. Doctor Camsell traced the importance of mineral resources as a factor in world affairs, and contented himself with presenting the high lights of the mineral history of Canada in their relation to colonization and industrial development. There was a paper by Ellis Thompson, describing a new method of mounting polished sections of mill products. Thompson, who was formerly in the Department of Mineralogy of the University of Toronto, is now on the staff at Harvard.

After the Institute luncheon, which was addressed by Doctor Sextant, principal of the Nova Scotia Technical College at Halifax, the lecture sessions were resumed. *A Lead and Zinc Deposit in Banded Formation* was described by E. S. Moore, Professor of Economic Geology in the University of Toronto. The *Marketing of Ores* was reviewed by George A. Guess, Professor of Metallurgy in the University of Toronto. Professor Guess discussed some of the problems which arise between the mines and the smelters in the bargaining attendant on the sale of ores. His paper was replete with actual examples, and was very specific in its references and deductions.

**An exhibit of rock drills, made in Canada, which attracted much attention during the recent convention.**

The big paper of the afternoon was the survey of the nickel industry presented by Paul D. Merica, Director of Research of the International Nickel Company, New York City. This paper provoked a great deal of discussion. Dr. W. A. Parks, who was in the chair, recalled conditions in the Sudbury area when he was employed there as a chemist in 1892. Dean W. L. Goodwin was also reminiscent, and had many points on which he wanted further information. The Deputy Minister of Mines for Ontario, T. W. Gibson, contributed to the discussion, as did several others, including E. H. Hamilton and E. P. Mathewson, both of New York City. Mr. Mathewson commented on the modesty of the gentleman who presented the paper and said, further, "we ought to have noticed that the nickel industry has found a new market for 50 per cent. of the nickel, formerly used by military agencies, in three years as the result of the careful work by Mr. Paul D. Merica and his excellent staff. This is the point we should bear in mind." To conclude the afternoon, Charles C. Ross, Senior Mining Inspector, Department of the Interior, who is located at Calgary, read a paper on *Petroleum and Natural Gas Developments in Alberta*. Mr. Ross showed some pictures of the now famous Royalite well, which he described in detail.

General relaxation characterized the smoker held on the evening of that day. Under the guidance of John Ness, geologist of the Imperial Oil Company, the smoker program was run through from the presidential address by Mr. Ness to the refreshments, served at the close. Mr. Ness created for himself an enviable reputation as a humorist as the result of the skillful presentation made by him on the subject of *Petroleum and Allied Substances*. Much new material on the subject was adduced by him; and while there may be some question as to the soundness of his geological deductions, there was no doubt as to the value of the address as a mirth-provoking venture. An excellent program of music, and pictures, and boxing bouts filled in the evening.

**The Britannia concentrator is one of the largest copper producers on the Pacific coast of Canada.**

There was a third day to the session. In this day's program more attention was paid to new developments. Some of the features covered were: the Goudreau gold area; the new Red Lake area of Patricia; the development of gold mining in Nova Scotia; the marketing of Manitoba limestone from the Tyndall area; developments in Rouyn and other parts of northern Quebec, etc.

Rouyn, Quebec's new gold field, is really an extension into Quebec of the mineralized area known as the Kirkland Lake camp in Ontario. Many claims have been staked in this new camp, and a good deal of development work has been done. The town of Rouyn has been created, and a railway is being built to provide the necessary transportation facilities. There has been an aeroplane service to this camp for a year or more.

Ontario's new Red Lake gold field is in the extreme western part of the province adjacent to Manitoba. The camp lies to the north of the transcontinental line of the Canadian National Railways and, at the present time, is 140 miles from the nearest railway station. There is, however, an aeroplane service, which has followed the dog teams. Contracts have recently been let for the breaking of roads through the rough country intervening between the gold camp and the railway.

One of the outstanding features of the developments in these two camps, Rouyn and Red Lake, is the fact that Canada's established mining companies have been among the first to do work in these new fields. When organizations like the Hollinger, the McIntyre, and the Dome, take up claims and proceed with active development work in a new area, the effect on the general public is very marked. Another and more important fact is that these new camps will be more efficiently developed than any new areas that have been opened up in Canada heretofore. There will be less waste of time and effort, and definite results will be forthcoming in a much shorter period than when the country depended upon individual prospectors to do all the work. In Rouyn several considerable bodies of ore have been blocked out. A smelter will be built this year. The metallurgy of the ores, it is said, presents no difficulties. Gold, silver, copper, lead, and zinc will be produced.

When the blanket of snow goes, it will be possible to form a more definite opinion in respect to the possibilities of Red Lake. The geology of the area was worked out about two years ago by E. L. Bruce, who read a paper on this subject at the Montreal meeting. It is of interest to note that, in spite of the present gold rush into the Red Lake area, prospecting in that district dates back to about 1893, when a rather pretentious camp was built on the lake shore. But from then on until 1922 there

**This exhibit of the Ontario Department of Mines is striking evidence of the richness of the mineral deposits in that province.**

was no further examination of the mineral possibilities of the region.

The concluding feature of the meeting was the banquet in the Rose Room of the Windsor Hotel with the Honorable Charles Stewart, Federal Minister of Mines; Honorable J. E. Perrault, Minister of Colonization, Mines and Fisheries, Quebec; Honorable Charles McCrea, Ontario Minister of Mines; F. Lynnwood Garrison of the American Institute of Mining and Metallurgical Engineers; and Colonel J. S. Dennis, of the Canadian Pacific Railways, as principal speakers. Genial good-fellowship prevailed throughout the party. Speeches, summing up the main features of the mining industry in the Dominion and the several provinces, were listened to with courteous attention. A silver tea service was presented to G. C. Mackenzie, the Secretary-Treasurer of the Institute, as a token of the regard in which he is held by his many friends and associates. Lewis Stockett, the new president, was in the chair; and there were many distinguished guests at the head table, including such well-known Americans as E. P. Mathewson and E. H. Hamilton, of New York City; J. V. N. Dorr, of The Dorr Company; F. Lynnwood Garrison, of Philadelphia; and Doctor Lyndgren, of Cambridge, Mass. After the dinner and the speeches, dancing was enjoyed for several hours.

One of the most interesting features of the mining meeting was the arrangement of some 24 exhibits relating to the mining industry. Samples of ores from some of the newer fields were shown; the work of the mines departments was exemplified in charts and maps; there were industrial exhibits of mining equipment and of products fabricated from Canadian metals. This was the first time that an attempt of this sort had been made; and the results obtained were found so productive of new business that the future of the enterprise is assured. It was Mr. Mackenzie's idea; and while some of the members of the Institute had at first looked upon the departure as undesirable their opposition was overcome.

**Headframe at Shaft No. 1 on the Horne property of the Moranda Mines, Ltd., at Rouyn, Quebec.**

In conclusion, there may be added just a note or two about the mining profession in Canada and about the development of its representative institute. The courses in mining and metallurgical engineering, and in general and economic geology, offered by the leading universities of the country have the reputation among mining men everywhere of being models of their kind; and it may be stated that the vast majority of those responsible for the operation of Canadian mines and metallurgical plants, as well as practically all the officers of the departments and the bureaus of mines, are Canadians who have received their training in the country.

As the industry grew, and the number of men engaged in it increased, a demand arose for an association of some kind through which mining men might come together from time to time for the discussion of mutual problems and to present papers dealing with mining methods, metallurgical practice, and allied subjects. To meet this need, the General Mining Association of the Province of Quebec was organized in January, 1891. In 1896, the Federated Canadian Mining Institute was established, and two years later the Canadian Mining Institute was incorporated, replacing the older organizations. For more than 30 years Nova Scotia had its mining society, but in 1918 that society became affiliated with the larger Canadian Mining Institute which, in 1920, broadened its title and became the Canadian Institute of Mining and Metallurgy. The Institute, which is held in high esteem, is thus representative of these industries, from coast to coast; and its Transactions form a very complete history of the great progress which mining and metallurgical practice has made in Canada during the last quarter of a century.

In all this work, much of the progress made has been due to the Institute's energetic and efficient secretary, George C. Mackenzie. His tact and broad knowledge of mining and metallurgy in Canada have made him invaluable to the industry.

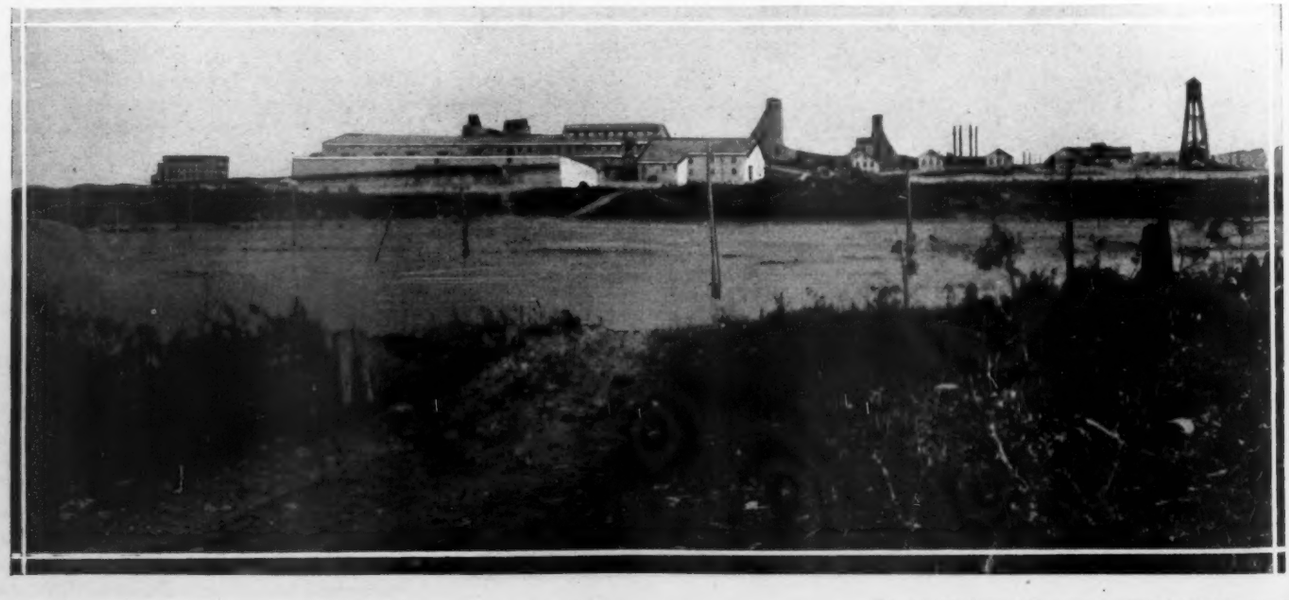


Photo. National Resources Intelligence Service.

**Ontario has in the Hollinger Mine her largest gold producer.**

# Flexible Joint That Remains Tight

By THE STAFF

PIPE lines carrying compressed air, gas, or liquids of any kind under pressure present a more or less troublesome problem in stopping leakage. Not infrequently, wastage thus incurred at joints becomes both serious and costly; and this wastage is apt to increase in relation to the length of the line, the size of the piping, and whether or not the conduit is laid on the ground and assembled in a somewhat rough-and-ready manner.

**A 10-inch main, carrying flood water from a mine pit to the River Tyne. This main, 360 feet long, was assembled and made ready for service in 12 hours by using flexible joints.**

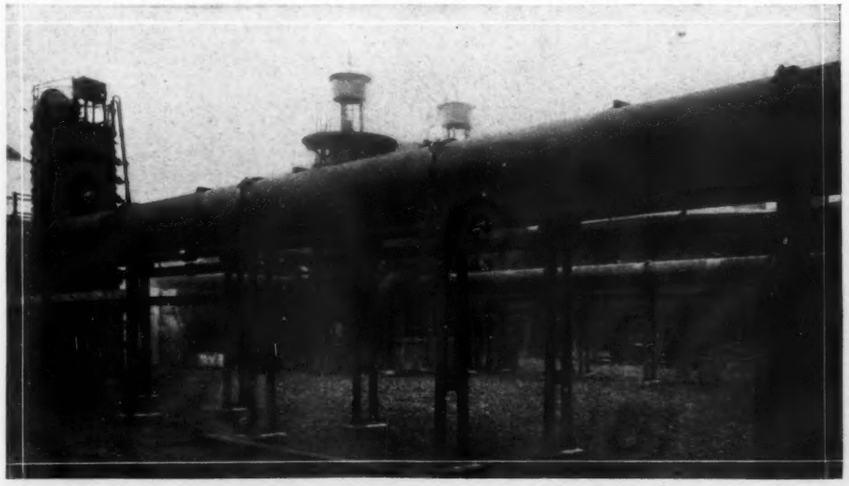
In mining work, as well as in other rugged operations, pipe lines are often carried through irregular passages or laid on uneven ground where subsidence may strain joints. Ruptures may occur at numerous points; and, unless repairs are made promptly and the lines inspected at frequent intervals, the leaks may lead to either a large loss of power or to the escape of liquids and gases in transit. The gravity of this matter of leakage is of common knowledge to men engaged in all departments of industry.

Inasmuch as the greatest loss occurs at defective joints, the correction or the reduction of the trouble lies in devising a joint which can be made tight and which will remain tight when subjected to the severest service stresses and yet afford a satisfactory measure of flexibility. These requirements are not ordinarily met by the familiar thread-and-coupling joint; but, after protracted investigation and much experimenting, a joint has been evolved that meets admirably conditions such as we have just described. This joint contains a rubber sealing ring which is completely encased in a metal housing that engages the adjacent ends of the piping—thus providing the desired closure as well as the necessary flexibility.

The inner ring employed in the case of the flexible joint in question has the form of the letter C, laid on its face, with the open side downward. To hold this ring in place, a metal housing has been devised which closely fits the outside contour of the rubber ring and engages shoulders or grooves machined in the neighboring ends of the pipe sections so as to prevent the pipe ends from drawing apart when subjected to a longitudinal pull. This joint not only insures a positive seal when assembled, but its tightness is made even more secure when internal pressure is applied to the pipe line. This is because the internal pressure is transmitted to the inside of the rubber ring and causes that member of the joint to press its lips hard against the outside ends of the piping—the enveloping metal housing holding the ring firmly in place the while. The abutting pipe ends are set slightly apart, and this permits internal pressure to reach the ring. This arrangement also takes care of longitudinal expansion of the line as well as any flexure of the sealing ring, itself. In short, pressure in the line serves to tighten and to increase the sealing effect of the flexible joint.

The foregoing description outlines in principle the construction and the action of what is known as the Victaulic Leaktite Flexible Pipe Joint. The parent company, the Victaulic Company, Ltd., of London, England, has been operating since 1919, and joints of this description, so we are informed, have been placed in service in well-nigh every section of Great Britain and continental Europe. Today, joints of this sort are used in compressed-air lines as well as in lines carrying crude oil, water, brine, ammonia, natural gas, etc.; and reports indicate that they have been equally successful in all these services.

Victaulic joints were utilized some years ago in one of the big collieries at Newcastle-on-Tyne, and the results were so satisfactory there on compressed-air lines that many other collieries followed suit. In each instance, so it is reported, a decided saving was noted in the consumption of power by the compressors, while higher air pressures were maintained at the ends of the mains where the tools drew operating air. All told, more than 360 collieries in the British Isles are now equipped with Victaulic joints.

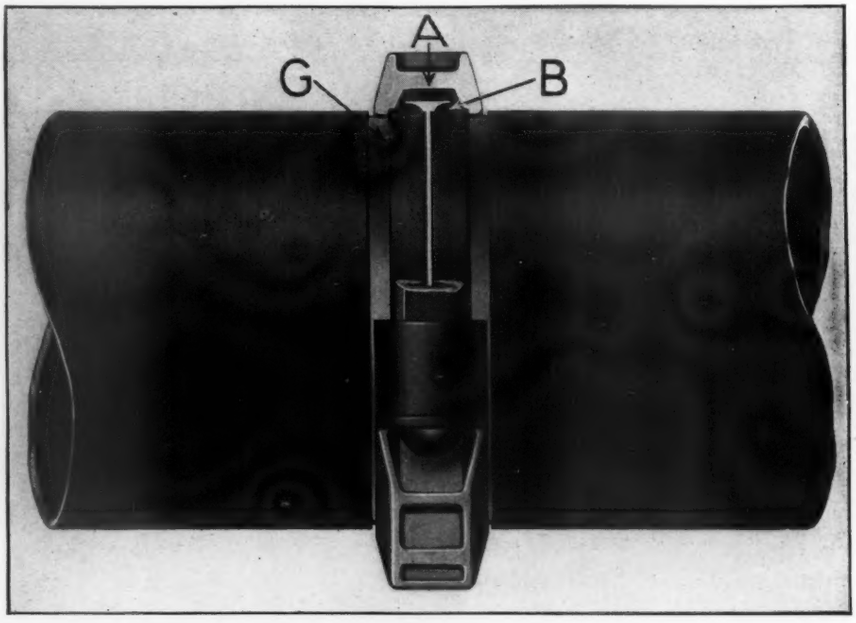


**Overhead mains at the Provan Gas Works, Glasgow, Scotland, which are fitted with flexible joints.**

A point that deserves emphasis is that joints of this type facilitate the making and the breaking of joints; and the savings in time and labor in doing such work are noteworthy. Experience has revealed that these joints can be fitted by unskilled labor in from one to four minutes each in piping ranging from 2 inches to 12 inches inside diameter. Following a colliery disaster at Newcastle-on-Tyne, a 10-inch water line was assembled in a vertical shaft, 360 feet deep, in twelve hours. A 10-inch flanged-joint line

of the same length, placed in the same shaft, required 96 hours to install.

The Victaulic Company of America, with offices in New York City, informs us that Victaulic joints, for hydraulic work, are constructed so that they will withstand a bursting pressure ranging from 1,000 to 4,000 pounds per square inch. Pipe manufacturers in the United States are prepared to furnish piping grooved for the fitting of Victaulic joints and at a lower cost than when the pipe ends are finished with standard threads.




**Details of the Victaulic flexible pipe joint. A, metal housing; B, inner sealing ring; and G, groove in plain-end pipe.**

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At the annual meeting of the British Aluminum Company it was brought out that the world's annual consumption of aluminum is already nearly double that of tin and that only three other of the nonferrous metals—copper, lead, and zinc—are used in greater quantity. As salts of aluminum are more widely and plentifully distributed throughout the earth than those of any other metal, not excepting iron, an ample supply of the mineral is assured for a long while to come.

## WHAT IT MEANS TO STORE GAS FOR DISTRIBUTION

THE storage of manufactured gas for distribution, as needed, through service mains has cost the gas companies of the United States, according to a bulletin published by the American Gas Association, approximately $125,762,670 in gas holders. This investment represents an overhead that the electric industry is not burdened with, as storage costs and distributing costs are independent items of expense.

To maintain an unfailing supply of gas in this country, 1,143,297,000 cubic feet of holder space has been provided; and it has been computed that it would take an ordinary kitchen gas range with four top burners and two oven burners nearly fourteen years to consume all the gas contained in one of the largest gas holders now in service. The introduction of the carbureted water-gas process, which enables gas to be manufactured almost at will, will undoubtedly reduce gas-storage requirements.

## TANK CARS FOR HELIUM GAS

HELIUM gas for dirigibles has heretofore been stored or transported in small cylinders of which about 1,200 are generally required to charge an airship having a capacity of 210,000 cubic feet. As can be readily appreciated, much labor is involved in filling and in handling these containers. Not only that, but there is considerable loss through leakage, as much as 15 per cent. of the contained helium, so it is said, being dissipated in this way.

To cut down the cost of handling and to prevent as much as possible the escape of this precious non-inflammable gas, the Bethlehem Steel Company has built for the United States Army Air Service a tank car in which can be stored enough helium to charge a blimp of average size. A similar car is to be provided for the navy.

Official Photograph, U. S. Army Air Service.

**Type of tank car devised to transport helium for the United States Army Air Service. Each triple-cylinder car is capable of holding 206,000 cubic feet of helium stored at a pressure of 2,000 pounds.**

Each car consists of three long cylinders which, combined, have a carrying capacity of 206,000 cubic feet of helium at a pressure of 2,000 pounds per square inch. Each tank is hollow forged on a mandrel from a single ingot of carbon-vanadium steel—the ends terminating in bottle necks which are provided with cover plates and thin gaskets snugly fitted against machine-ground surfaces to insure permanently tight joints.

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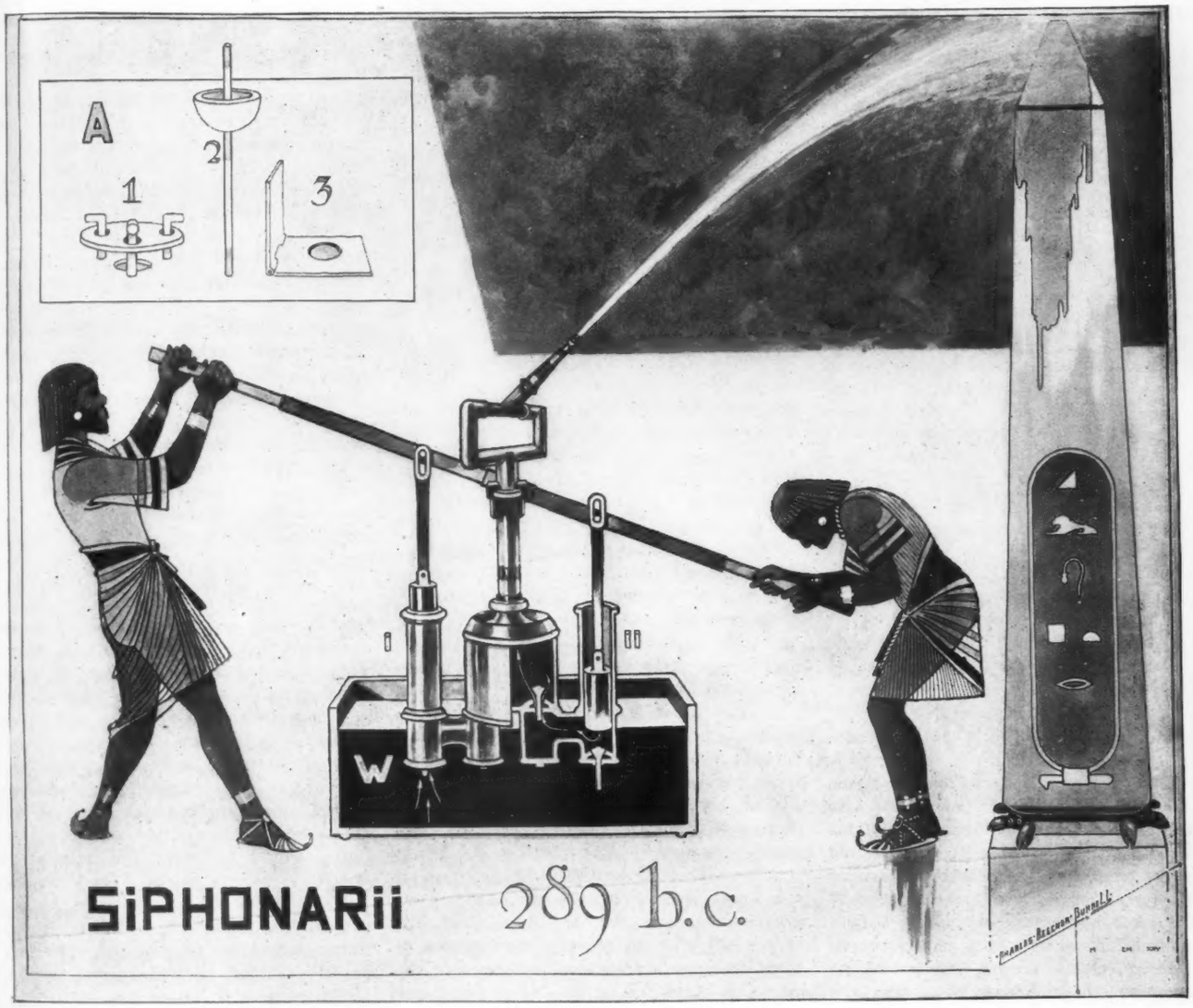
More than 250,000 acres in the Juarez district of Mexico are involved in a huge colonization scheme. An Italian capitalist, in America, has acquired rights to the area and is reputed to have 5,000 Italian families ready to emigrate to Chihuahua and to settle on the land. It is expected that families will be transported, financed, and furnished with farm animals and implements for one year after arrival. All heads of families are to apply for Mexican citizenship at once, so that they may acquire the land and hold it without complications.

## DAMMING A RIVER TO MAKE UPHOLSTERY

OPERATIONS have been begun by the Ford Motor Company on the damming of the Huron River, south of Ypsilanti, Mich., to develop 4,500 H.P. eight hours a day—the plan also involving the erecting and the equipping of a new factory for the manufacture of woolen upholstery and head linings for Ford cars. The damming of the river will create a lake five miles long and from one-half to three-quarters of a mile wide; and on the land to be submerged there is being cut about 1,000,000 feet of lumber—one-sixth of which is black walnut.

It is estimated that the dam and hydro-electric power plant will cost $1,200,000. The factory will be made up of two sections, each measuring 350x1,000 feet, and will involve an outlay, including equipment, of $3,000,000. In view of the fact that the upholstery cloth used in Ford cars in 1925 cost $2,225,509 and the linings $3,947,855, there is ample warrant for this undertaking.




## FORERUNNER OF THE MODERN FIRE ENGINE

**THE fire engine is not so modern as most of us may be inclined to imagine. The portable fire pumps used by "fire laddies" only a few decades back were anticipated by inventive Alexandrians nearly three centuries before the beginning of the Christian era—at least that would seem to be established if the records handed down to us by ancient writers on technical subjects can be believed.**

**The term siphon had a very different meaning in the centuries gone from what it now has. In 289 B. C. the word siphon was used to designate a fire engine, while the word "siphonarii" was the designation for firemen.**

**To that prolific Alexandrian author, Hero, our artist is indebted for the data forming the basis for the accompanying illustration; and his drawing depicts a type of fire engine that was small enough to be moved easily about from place to place and that could draw water from any available fountain or other convenient source of water. The letter I indicates the position of the left-hand piston at the end of the upstroke, while II shows the right-hand piston on the downstroke—with its cylinder cut open to disclose the manner in which the water flows from the reception chamber to the distributing chamber. At W, the arrows mark the direction in which the water moves when entering the left cylinder.**

**Should anyone be disposed to doubt the existence of a fire pump twenty-three centuries ago, he should be reminded that a pump much the same as that now pictured was twice described by Hero; and a British Museum exploring expedition found two bronze pumps of a kindred sort on the site of an ancient Etruscan city where they had been plowed under after that place was destroyed something like 300 years B. C. In principle, those pumps were much like other pumps devised by Ctesibios—said to have been the father of Hero. And when it comes to matters of detail, we know that Hero left in certain of his works specific instructions telling how to turn pistons and how to bore cylinders.**

**Within the rectangle, marked A, are illustrations of several types of valves devised by Hero and suitable for use in pumps.**

New York City, with approximately 5 per cent. of the population of the country, requires annually 5,000,000,000 kilowatt-hours of electrical energy—that is, close to 12 per cent. of the energy developed by all the power-generating stations in the United States.

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According to *Commerce Reports*, a German firm has put on the market a new type of electrical condenser for power-factor correction. Briefly, the condenser consists of a high-capacity cable, varying in length, wound on a frame and submerged in a bath of oil.

## MINUTE OBJECTS CAN NOW BE SUPERMAGNIFIED

PHOTOMICROGRAPHY—the photographing of infinitesimal objects under powerful microscopes—has been developed to a high degree by R. G. Guthrie, of Chicago, according to a writer in *Machinery*. Recently, Mr. Guthrie was able to photograph and to enlarge the structure of a piece of steel 15,500 diameters in a single projection. It is possible to get a conception of the magnitude of such an enlargement when it is realized that the head of a pin—3/32 inch across, similarly magnified, would measure 116 feet in diameter. The combination of lenses in the instrument used by Mr. Guthrie is capable of separating and photographing lines lying so close together that 200,000 would not take up more than a square inch of space.

The Leitz micrometallograph, as it is known, consists of a high-power microscope placed between a powerful arc light and an extremely sensitive camera. The whole outfit is 7 feet long, and it is so mounted on springs that any movement of the floor will not be transmitted to the instrument.

# Compressed Air Magazine

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*EDITORIALS*

## PAN-AMERICAN PRESS CONGRESS

LACK of reciprocal understanding is at the bottom of most discords among a people and between one nation and another. This lack of understanding often becomes acute where the countries immediately concerned speak different tongues. The fact that there is not a common language, a familiar medium of communication, readily lends an opportunity for misinterpretation and gives the intentional troublemaker a chance to exercise his talents.

The recent Pan-American Press Congress, in which representatives from both North and South America participated, promises to be of lasting value in the promotion of cordial relations between these neighboring continents. In so many ways, the interests of the two continents are interrelated; and there are social, commercial, and governmental forces that are identical and reciprocal in their aims for the commonweal of all the peoples dwelling in the Western Hemisphere.

It lies within the power of an understanding and a sympathetic press to do an immense amount of good in facilitating the interchange of international news and in presenting the facts in an impartial and a friendly spirit. Strange as it may seem, the people at large in North America are sadly unfamiliar with their neighbors to the south; and it is probably equally true that there are millions of people in South and Central America that are just as deficient in their knowledge of life and activities in North America.

Let us hope that the recent Congress has laid the foundation for ways and means that will be faithfully and enthusiastically utilized in stimulating, through the public press, a wider exchange of information of all sorts that will bind the two continents more closely together with bonds of understanding and friendly regard.

## OIL FOR OUR OIL ENGINES

OIL engines as prime movers are finding continually widening fields of application and are being used more and more within the fields where they are now firmly established because of their efficiency and their operating economy. Even so, there are many potential users of oil engines that hesitate to change from some other primary source of power because of a recurrent fear that they may suddenly find themselves facing a shortage of essential liquid fuel. This attitude has been to the disadvantage not only of the builder of heavy-oil engines but to the power user who has every reason to try to save his dollars wherever it is practicable to do so.

In the current issue of the Magazine, we are privileged to publish a message from an authoritative source which puts the subject of a sufficiency of oil fuel in a new and an extremely encouraging light. The author, JAMES O. LEWIS, a petroleum technologist and an erstwhile prominent official of the United States Bureau of Mines, discloses that there will, in all likelihood, be an abundance of fuel for oil engines for a long while to come.

At the present moment, comparatively speaking, much fuel oil is being wastefully burned under boilers to generate steam for steam engines. This oil could be used to far greater advantage—that is, with higher efficiencies—if employed instead to drive internal-combustion engines. Therefore, as MR. LEWIS sees it, it is inevitable that, as the price of oil rises, coal will surely take the place of oil for steam raising, and the oil so saved will be available for oil engines—any advance in price being no hindrance in view of what the oil engine can deliver in the way of power for every pound of fuel consumed.

Quite aside from this aspect of the subject, there is a notable tendency to drill still deeper wells, and thus to make available fuel sources that will probably add very largely to our supplies. Some of the deep wells so driven are producing in generous measure. Finally, there is a continuous effort to devise mechanical means and processes that will make it practicable to recover much larger percentages of oil from already exploited pools. In this latter work, compressed air is at the present moment stimulating the output of diminishing wells or reviving the recovery from wells that had ceased to yield under the commonly prevailing operating conditions.

## MOSQUITO A COSTLY PEST

WITH the coming of summertime, warm weather and stagnant water are the two agencies that hasten and continue the breeding of the pestiferous mosquito. No matter what the particular variety of that winged insect may be, most of them seem to be hungry for human gore and there are certain of them that have the capacity to transmit the germs of more or less disabling or deadly diseases. Even if we consider the mosquito from the single viewpoint of a nuisance, a source of irritation and wakefulness when we are most desirous of sleep, we know that the mosquito causes a loss through its reflex action upon property values and reduced human efficiency.

According to authoritative figures, issued a few weeks ago, it would seem that malaria—transmitted by the mosquito—incapacitates for longer or shorter periods every year a total of 3,000,000 persons in the United States. Expressed in another way, these cases of "chills and fever" entail a loss equivalent to an outlay of $100,000,000, or ninety-one cents per capita. Conversely, the eradication or the reduction of these swarms, besides contributing to the public health, adds measurably to the taxable value of property. In the State of New Jersey, for instance, where much excellent work has been done in abating the mosquito nuisance, an annual expenditure of $225,000 over a period of ten years has increased property values by nearly $44,000,000. These figures speak for themselves.

## DISSIPATING FOG BY ELECTRICITY

AS a climax to laboratory experiments conducted by DR. FREDERICK GARDNER COTTRELL, that creative scientist evolved a method of electrical precipitation by which suspended solid matter, that otherwise would be spread broadcast from smelter smokestacks, could be charged, arrested, and subsequently utilized. This process was designed to supplant the costly bag-houses employed in some smelters to recover metallic values that, without such a medium, would be lost. The principle upon which the process works is such that minute particles—either liquid or dry, when passing through an electrified field, are ionized in transit and caused to attach themselves to oppositely charged electrodes from which they can be removed at leisure.

The COTTRELL system of electrical precipitation—conceived in the first place to abate a serious nuisance—has won wide recognition in the industrial field, and is today in use in many places and in divers ways. It is recalled that during the years of the World War, when America's supply of potash could no longer be largely drawn from the potash mines in Germany, much of this plant food was obtained from the dust of cement mills by means of electrical precipitation. Besides helping to tide us over an emergency, the process was the means of earning many thousands of dollars.

A further adaptation of this method of ionizing tiny particles of matter in suspension in the air is now being worked out by the United States Naval Bureau of Aeronautics. Experiments of a decidedly promising character have been made by that bureau, and these lead to the belief that it will be feasible to utilize kindred apparatus to bring about the precipitation of fog within chosen areas at airplane landing fields. Work along this line was done by DOCTOR COTTRELL years ago—inspired by seasonal conditions in London; and the results of his tests at that time indicated that the day might come when a ship, surrounded by fog, could create a visible zone about her

which would lessen the likelihood of collision. Success in the latest investigations would do much to rob flying of one of its gravest hazards, and enable aircraft to see their landing places and to alight in safety even when the rest of the nearby country might be hidden by fog.

## KEEPING DAILY TAB ON SUN SPOTS

SOME of us read all changes in the weather from the rise or the fall of the thermometer. Others of us, more versed in the meaning of atmospheric pressure, watch the barometer for the same purpose. A few of us—very few of us—give heed to variations in the intensity of the sun's glow which, after all, has most to do with what happens to us from season to season, and even from day to day.

It has been known for years that spots on the sun temper in a more or less marked degree the radiant heat imparted to us by that celestial body; but only latterly has it been recognized that weather conditions over a considerable period can be predetermined by recording and evaluating from day to day the intensity of solar radiation. Therefore, the aim is to call into being solar observatories wherever atmospheric conditions lend themselves most favorably to the taking of such diurnal readings. This movement has been urged by DR. CHARLES G. ABBOTT, the solar expert of the Smithsonian Institution.

Within a short while, the Smithsonian Institution will be in a position to receive daily reports on solar radiation as measured at an observatory in South Africa. This station, now in the course of completion, will be at Brukkaros, in an arid mountain district populated in the main by Hottentots. Brukkaros was chosen principally because it is situated at a point in the Eastern Hemisphere where the atmosphere is very clear and, therefore, measurements of solar radiation will be correspondingly precise.

Wireless means of communication, and exquisitely sensitive heat-recording instruments will make it possible to keep tabs on the sun's temperature as reflected on this earth of ours and to follow the influence of sun spots where they bring about local barometric abnormalities and induce changes which promote storms or seasonal oddities. This far-flung and cumulative knowledge will, at least, safeguard us against surprise when the weather is not what we might otherwise expect it to be. Perhaps, in time, it may be practicable to publish a calendar that will be as accurate in fact as farmers' almanacs of other days aspired to be.

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Perhaps the recent statement of the Bureau of Explosives of the American Railway Association to the effect that more than 500,000,000 pounds of commercial explosives were transported by the railroad companies of the United States and of Canada, will be startling news to many citizens. These same citizens, however, can feel reassured when they learn that not a single person was killed or injured in handling this highly inflammable commodity, which required 375,000 cars in its shipment.

DISCOVERY, THE SPIRIT AND SERVICE OF SCIENCE, by Sir Richard Gregory. An illustrated volume of 347 pages, published by The Macmillan Company, New York City, and made available at a reduced price by The Chemical Foundation Incorporated, New York City.

THE preface of this absorbing book points out that attention has recently been focused on the position of science in the state, its relation to industry, and its relative neglect in education; and the object of the work is to remind the public of the unselfish nature of scientific endeavor and of the spirit that inspires the true scientist in his tireless labors.

As Sir Richard Gregory aptly tells us in his pages: "Scientific investigation is not usually undertaken with personal profit in view, and the discoveries to which it leads are not jealously kept within the precincts of the temple, but are offered freely to the world: self-help thus giving place to the higher attribute of help for others. This virtue, with the qualities of self-sacrifice, persistence, courage, duty, accuracy, humility, and hope may all be abundantly exemplified from the careers of men of science; yet such instances are rarely mentioned. From many countries and many times we have gathered incidents and allusions which display the nobility of scientific aims, and have accentuated them with words of wisdom from the biographies and writings of men who have devoted their lives to the extension of natural knowledge. In substance, the book thus largely consists of selected testimony, while in intention it is a stimulus to high endeavor."

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TURBO-BLOWERS AND COMPRESSORS, by W. J. Kearton, Lecturer in Engineering, University of Liverpool. A handsomely illustrated book of 333 pages, published by Isaac Pitman & Sons, New York City. Price, $6.00.

THE volume is the first work of its kind published in England dealing solely with the design and the operation of turbo-blowers and compressors. The book contains a full treatment of the designing of such machines, their construction, and their operation; and the purpose of the volume is to supply this information to designers, to plant managers, and to students.

As the author explains, "In almost every other branch of engineering, the engineer or the engineering student is in the happy position of being able to turn to numerous articles, papers, etc., appearing in the technical press or in the proceedings of the various learned societies. So far as publications in English relating to turbo-blowers or turbo-compressors go, this is certainly not the case. Most of the serious articles are in German, and it cannot be said that all these are free from error." Mr. Kearton has rendered a real service to the engineering fraternity.

PIT AND QUARRY HANDBOOK, for 1926, edited by H. W. Munday. An illustrated book of 576 pages, published by Complete Service Publishing Company, Chicago. Price, $5.00.

THIS excellent work differs in many respects from previous editions, and is notable because it represents the combined efforts of a dozen specialists who have collaborated with the editor. All told, the volume contains 30 different sections, each of which deals with some outstanding phase of the activities covered by the related industrial field. To be specific, the work includes those departments of mining and quarrying that have to do with the production of certain non-metallic minerals, and principally with those concerned in providing cement, lime, gypsum, crushed stone, sand, and gravel. The handbook should prove a worth-while edition to the busy man engaged either in the primary handling of these products or in their subsequent utilization in one way or another.

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COMPRESSED AIR AND ITS MACHINERY, by T. H. Plummer, D.Sc. An illustrated book of 220 pages, published by The Association of Engineering and Shipbuilding Draftsmen, London, England.

THIS book has been written for practical men who have reason to employ compressed air for one purpose or another in their professional work, and therefore tabular data, drawings, and other information are gathered together in a manner which renders them easily accessible for reference.

As the author points out: "During the last 30 years or so, the use of compressed air and its machinery has made great strides, not only for the purpose of transmitting power to distances but also as a medium for employment in many engineering processes—it being now largely used in mines, collieries, engineering works, tunneling, quarrying, sewage work, chemical work, breweries, etc. In many circumstances it is superior to electricity for the transmission of power, and for many requirements essential in nearly every branch of industry, whilst being at the present time the best power for driving rock drills and portable tools."

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*Rate of combustion of coal-dust particles* is the title of a bulletin prepared by Messrs. Craig M. Bouton and J. H. Hayner, respectively of the research staff of the United States Bureau of Mines and of the Carnegie Institute of Technology. This is Part II of the investigation, and is devoted especially to a study of the effect of particle size upon pressure increase attending the flammation of coal dust. Published by the Carnegie Institute of Technology, Pittsburgh, Pa. Price 50 cents.

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*Methods and costs of rock-dusting bituminous coal mines,* by Messrs. C. W. Owings, of the United States Bureau of Mines, and C. H. Dodge of the Carnegie Institute of Technology. This bulletin, issued by the Carnegie Institute of Technology, Pittsburgh, Pa., deals with this important topic in a comprehensive manner, and should be valuable to any one concerned with the problem of preventing explosions in coal mines. Price, $1.50.

*Compressibilities of gases* is the title of a publication issued by the United States Bureau of Standards. The pamphlet is made up in the main of graphs for computing the compressibilities of air, argon, helium, hydrogen, methane, neon, nitrogen, and oxygen, and for computing the volumes delivered from cylinders containing argon, helium, hydrogen, nitrogen, and oxygen at high pressures. Procurable from the Superintendent of Documents, Government Printing Office, Washington, D. C. Price 10 cents.

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The United States Bureau of Mines has recently published the following new publications, which can be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C.:

BULLETIN 236. *Plastic magnesia,* by Oliver Ralston, Robert D. Pike, and Lionel H. Duschak. 1925. 106 pp., 13 pl., 27 figs. 30 cents.

TECHNICAL PAPER 347. *Analyses of Alabama coals,* by Charles Butts. 1925. 111 pp. 15 cents.

TECHNICAL PAPER 368. *Paraffin wax and its properties; methods of testing wax and of analyzing oil-wax mixtures,* by L. D. Wyant and L. G. Marsh. 1925. 26 pp., 4 pl., 6 figs. 10 cents.

*Phosphate rock in 1924,* by George Rogers Mansfield. 1925. 35 pp. 10 cents.

*Magnesium and its compounds in 1924,* by J. M. Hill and G. F. Loughlin. 1925. 15 pp. 5 cents.

*Salt, bromine, and calcium chloride in 1924,* by K. W. Cottrell. 1925. 8 pp. 5 cents.

*Slate in 1924,* by G. F. Loughlin and A. T. Coons. 1925. 9 pp. 5 cents.

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## A CORRECTION

"Editor, Compressed Air Magazine:

"In the article appearing in the May issue of your Magazine and entitled, *Close Gap in Hetch Hetchy Aqueduct,* the statement is made that the 60-inch riveted pipe was tested for tightness with compressed air in the shop and again after being laid. This is erroneous, both tests having been made by hydrostatic pressure.

"The writer of the article may have confused the test on the 60-inch pipe with that on the 42-inch submarine pipe. The submarine pipe is given a preliminary test under 50 pounds air pressure in order that leaks in leaded joints may be located by the bubbles rising through the water. After the leaks thus found are stopped, the submarine pipe is filled with water and again tested under hydrostatic pressure of 170 pounds.

"The concrete caisson which is mentioned as having a diameter of 77½ inches is actually 80 feet in diameter.

"M. M. O'SHAUGHNESSY,
"City Engineer, San Francisco."

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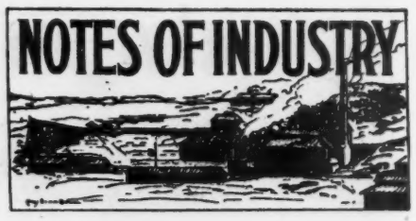
Artificial wool, with sulphite pulp as its basic raw material, has now reached a stage in its development where its manufacture on a commercial scale is being seriously considered in Canada.




In an effort to lower the cost of production and to increase output, a campaign is underway in Germany to completely modernize the paper-making industry. It is reported that one large newsprint plant near Stettin has already installed a new electrically driven machine capable of producing a roll of newsprint approximately 19½ feet wide and 1,150 feet long every minute, or 132 short tons of paper in a 24-hour day. This machine is said to be the largest of its kind in use in Europe.

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Preliminary figures compiled by the Federal Tariff Commission reveal that the American dye industry has made great strides last year not only in the matter of output but in the production of new fast colors. A total of 86,000,000 pounds of dyes, valued at $40,000,000, were manufactured in 1925—representing a 25 per cent. increase in output over 1924. This is a fine showing in view of the fact that it was not so long ago that we depended on foreign sources for most of our supplies.

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The movement to promote winter construction in the United States is apparently bearing fruit, as the contracts awarded during the fall and winter months of 1925-1926 have been the largest on record. Comparative figures, covering building contracts let in 36 eastern states during the four months ending March 1, 1925, and March 1, 1926, respectively, show an increase for the 1925-1926 season of $470,000,000.

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Through the combined efforts of the Division of Simplified Practice and of the manufacturers, distributers, and users of grinding wheels, it has been possible to eliminate 64 per cent. of the different kinds and sizes of grinding wheels heretofore manufactured and demanded by the trade—in short, to cut the number of varieties from 715,200 to 255,800. It is estimated that this greatly reduced list of sizes will actually result in an annual saving to the industry of $5,000,000.

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Nevada contains the largest area of unreserved public lands in the so-called public-land states in the United States—approximately 74 per cent. of its total area of 111,000 square miles being vacant and available for entry under the homestead laws.

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The proposition to increase the length of railroad rails from 33 to 39 feet has been approved by the American Railway Association. It is claimed that the consequent reduction in the number of joints will result in smoother riding and greater safety.

According to a statement issued by the government satistician for New South Wales, the Commonwealth of Australia is making unusual industrial progress when it is taken into account that the population of the entire country is slightly less than 6,000,000. During 1924-1925, the number of factories was increased by 580—bringing the total up to 126,305, while the output showed a proportionate increase in value of £11,536,000.

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The DuPont Blasters' Handbook, recently issued, describes a novel method of removing wooden piles by severing them below the water line by means of 60 per cent. straight dynamite detonated with electric blasting caps.

For this work, the cartridges are tied together like a string of sausages; fastened loosely around the pile to be dismembered; and then lowered to the point where the cutting is to be done. Firing the charge completes the operation.

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The immersing of a sheet of drawing paper, bond paper, typewritten copy, or other grade of paper in kerosene is a simple and effective means of securing the desired transparency for the purpose of reproducing blueprints from original tracings, etc. Furthermore, says G. A. Luers, in the *National Engineer,* few draftsmen appreciate the fact that it is possible by the aid of a kerosene bath to obtain a blueprint from a blueprint as long as the original is clear and sharp. The blueprint to be reproduced is soaked in the kerosene, and then the excess oil is removed by placing it between blotters. This bath in no wise impairs the original, for after printing the oil is readily evaporated by exposure to the air.

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Several months ago, the United States Bureau of Mines distributed a questionnaire asking for opinions regarding the proposed change from the gallon to the barrel—consisting of 42 U. S. gallons—as the unit for liquid refined products. A majority of four to one was in favor of the change. As a result, the Bureau of Mines has decided to substitute the barrel unit of measurement in place of the gallon unit of measurement heretofore employed. To effect the change, the coöperation of the petroleum and all allied industries is sought; and in order not to destroy the value of existing figures and graphs, the Bureau of Mines is prepared to alter this data so that it will conform to the new standard.

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The first of four new paper machines, which will make the International Paper Company's plant at Three Rivers, Que., the largest newsprint mill in the world, was recently operated for the first time. When all four of these machines are in service, about the end of July, the capacity of the mill will be increased from 320 to 700 tons of paper a day. Just what this means can be better appreciated when it is realized that 700 tons of paper go into the make-up of four million 24-page newspapers a day.